

Aviation Week & Space Technology

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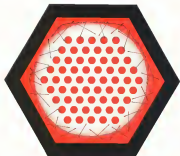
A McGraw-Hill Publication

September 30, 1963

**Boelkow Gains
Major German
Space Role**

**United Air Lines
Boeing 727 Transport**





PROGRESS IN COMPACT NUCLEAR POWER PLANTS

Extensive preliminary studies of advanced mobile and transportable nuclear power plants have been made by Aerojet-General Nuclearco., using proven technology and components derived from America's first mobile nuclear power plant, the ML-1. The ML-1 is being developed by AGN for the Atomic Energy Commission and the Army Corps of Engineers. ■ The AGN studies covered the power range from 100 kw to 3 Mw—with applications ranging from the Antarctic to space, and emphasis on economy, reliability, and safety. ■ Fundamental to these studies: a practical, straight-forward fuel element successfully operated for 10,000 hours at full power, at a coolant temperature of 1200°F...with no fission product release...and no sign of failure. ■ Based on these results, core lifetimes of several years are clearly feasible. ■ For information on AGN's programs in mobile nuclear power, write for AGN Active File #2.

AGN

AEROJET-GENERAL NUCLEONICS / San Ramon, California



FIND MANY UNUSUAL STRUCTURAL USES



Hi-Loks being installed in fuselage using a straight-in air motor.

With a reputation earned as a controlled-profile, high-strength fastener for the primary structure of high performance aircraft, the Hi-Lok fastener finds usage today in a variety of unusual structural applications—even missile shipping containers.

Selected because of its simplicity of installation and uniform clamp-up, thousands of Hi-Loks are used in the structure of the SSCBM, a Boeing developed shipping and storage container used for the air or rail delivery of the USAF solid propellant Minuteman ICBM. This container cradles the missile against shock and vibration while maintaining precise levels of temperature and humidity.

The Hi-Lok in the SSCBM aluminum structure retains a predictable clamp-up or pre-tension constant to $\pm 10\%$. This controlled pre-load makes the Hi-Lok ideal for fastening

other structural materials such as reinforced plastic to plastic, plastic to metal, wood to metal, aluminum to steel and steel to steel in shockproofed, for instance, in naval ship construction.

Hi-Loks are installed with inexpensive, standard air-motors fitted with adapter tooling. This tooling permits easy installation in open as well as in restricted areas. Hi-Loks can even be installed and removed with standard hand tools.

Hi-Lok fasteners are available in nominal diameters to size 5/32 thru 3/4 in. diameter and commercial lengths. Hi-Loks are made in all commonly used high strengths and lengths for fastener materials.



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Look into



UNIQUE
SYSTEMS
CAPABILITIES



System project managers can save time and money, and achieve operational hardware faster, by working with Reeves' experienced design and production teams.

Reeves' comprehensive experience in the field has led to our excellent military project achievements. This experience, coupled with our extensive, recently upgraded production and test facilities, permits us to take on major assignments.

A review of what Reeves has done, is doing, and can do, will demonstrate the unique character of our capabilities... for systems, subsystems, assembly and component development, engineering, production, supply and field service. Data file 709 on request.

FOR EXAMPLE: TRACKING RADAR SYSTEMS

Reeves' rich experience in tracking radar gives a broad spectrum, to the long range limit, Reeves' latest... Very Long Range Tracking Radar... is doing the most accurate systems available. Field proven in extreme ranges, the long functional use, performs such duties as: ranges at 3,000 miles and beyond.

Another unusual Reeves development, the Radar-Battle Sizing Central, AN-1000-200 systems, tracks and displays the tracks of aircraft and weapons of forces in practice on the wide perimeter by air, ground, and not only tracking, the Central produces continuous plots of aircraft position and battle situation, in forward and rearward planes, maximum range 100 miles at altitudes to 300,000 ft.

These tracking systems have been designed for compact housing in air transportable vans for field service. They provide Reeves' comprehensive capabilities in systems, production, from concept to delivery of operational hardware.



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Reeves Systems engineering... management... production... field services

AEROSPACE CALENDAR

- Oct. 7-Second Annual USAP Contract Aerospace Services Symposium, Dayton Aviation Hotel, Dayton, Ohio. Sponsor: National Aerospace Services Assn.
- Oct. 7-8-North National Communications Symposium, Institute of Electrical and Electronic Engineers, Hotel Utah, Utah.
- Oct. 9-10-International Air Transport Assn. 19th Annual General Meeting, Rome, Italy.
- Oct. 14-William Tell 1965, USAF Interservice Weapons Meet, Tyndall AFB, Fla.
- Oct. 15-Conference of Military Engineers: Committee Meeting, National Assn. of Commun. Engineers, Albrook Station Hotel, Mobile, Ala.
- Oct. 14-15th Annual Air Force Research and Engineering Symposium, Air Force Aerospace Club, Aerospace Office of Aerospace Research, AFOS.
- Oct. 13-14th National Airport Conference, Norman, Okla. Sponsors: American Assn. of Airport Executives & University of Oklahoma with the cooperation of FAA.
- Oct. 14-15th International Conference on Electromagnetic Interference, University of Nevada, Reno.
- Oct. 14-15th Electronics and Space Navigation Exposition, Seattle, Wash. Sponsors: Electronic Equipment Assn., Instrument Society of America.
- Oct. 14-15th Annual Aerospace Electronics Conference, Aerospace Electronic Society, Pan Pacific Auditorium, Los Angeles, Calif.

(Continued on page 7)

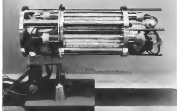
AVIATION WEEK & SPACE TECHNOLOGY

September 30, 1965
Vol. 79, No. 14

... another product of LSI research

The LSI research capabilities that made these new products possible can serve you too. Why not write us to find out how we can assist you in taking advantage of a rapidly advancing laser technology?

The 150-joule LSI Laser, shown below with reflectors and clear removed, uses four water-cooled laser flashtubes in a clear-draft elliptical cavity to achieve its high output.



LEAR SIBOUR, INC.



LASER SYSTEMS CENTER
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Anything on Earth can be put into J-M Thermomat... the most versatile asbestos-phenolic molding mat available

Electronic compounds, silicones, dyes, asbestos fibers, organic and inorganic fillers—these are some of the things we have already added to J-M Thermomat. What else can be added? You name it whenever you specify Thermomat we find it. What's more, custom formulations can be made for you at little or no extra cost.

On the job, Thermomat has a lot to offer, too. It is a plastic, conformable product that readily lends itself to molding, tape winding and hand lay-up. Available in sheet and tape form, Thermomat gives parts and components rugged protection in critical areas. Because the asbestos fibers remain free-flowing during molding, Thermomat produces uniformly reinforced parts that offer maximum resistance to heat, abrasion as well as to solvents and acids. And, they have a high strength-to-weight ratio.

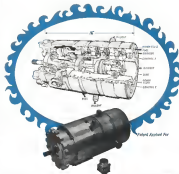
That is, more than a hundred different formulations of Thermomat have been produced in numerous thicknesses and weights. Yet, it is but one of a wide variety of asbestos materials made by J-M for use in reinforced plastics... the widest range of such materials available to the aerospace industry! For details, write to Aerospace Products Group, Johns-Manville, Box 14, N.Y. 10, N.Y., Cable address: Johnmanvil.

THE NAME TO THINK OF FIRST FOR ASBESTOS... **JOHNS-MANVILLE**

AEROSPACE CALENDAR

(Continued from page 5)

- Oct. 10-11-National Engineering Conference, Lakewood Hotel, Long Beach, Calif. Sponsors: Professional Engineers in India, Inc.
- Oct. 12-13-1951 General Conference, Fuel Institute Aerospace International, Mexico City.
- Oct. 13-15-1951 Annual Meeting and Conference, Airport Operators Council, Sheraton Hotel, New Orleans, La.
- Oct. 14-Medical Annual Exposition and Symposium, Air Traffic Control Assn., Sheraton Hotel, Dallas, Tex.
- Oct. 15-16-World Magnesium Congress, Queen Elizabeth Hotel, Montreal.
- Oct. 14-16-Ballistic Symposium on Ballistic Missile and Space Technology, Naval Training Center, San Diego, Calif. Sponsors: AF Space Systems Div., AF Ballistic Systems Div., Aerospace Corp.
- Oct. 16-Second Annual Technical Conference, Society of American Value Engineers, Airport Marquis Hotel, Los Angeles.
- Oct. 16-18-Tenth National Vacuum Symposium, American Vacuum Society, Sheraton Hotel, Boston, Mass.
- Oct. 17-Tenth Annual Air Day Technical Symposium on Information Processing in the National Capital, University of Maryland, College Park, Md.
- Oct. 17-18, Oct. 20-22-North Anglo-American Conference, American Institute of Aeronautics and Astronautics-Canadian Aeronautics and Space Institute-Scottish Aeronautical Society, Massachusetts Institute of Technology, Cambridge, Mass. Oct. 17-19, Queen Elizabeth Hotel, Montreal, Canada (Oct. 11-12).
- Oct. 20-22-Tenth Annual East Coast Conference on Aerospace and Navigational Electronics, Institute of Electronics and Electronics Exposition, Emerson Hotel, Baltimore, Md.
- Oct. 21-22-Annual Meeting, Asst. of the U.S. Army, Sheraton Park Hotel, Washington, D.C.
- Oct. 21-23-24th National Conference, Society for Nondestructive Testing, Fair-Carter Hotel, Cleveland, Ohio.
- Oct. 22-24-Conference on Expandable Structures, National Civil Engineers Club, Seattle, Wash., Oct. 22-24, Seattle, Wash. Sponsors: American Society of Mechanical Engineers, American Society of Naval Engineers, American Society of Heating, Refrigerating and Air Conditioning Engineers.
- Oct. 25-26-Annual Meeting, Western Pacific Soc. Security Radio's Hyatt Hotel, San Francisco, Calif.
- Oct. 25-26-1951 Annual Aerospace Fluid Power Conference, Fullerton Sheraton Hotel, Fullerton, Calif. Sponsors: Aerospace Div. of Victor Inc.
- Oct. 26-28-Fall Meeting, Western Space Section/The Cosmonauts Institute, University of Southern California, Los Angeles, Calif.
- Oct. 28-29-National Electronics Conference, McCoskey Hotel, Chicago, Ill.
- Oct. 29-31-International Symposium on Plasma Phenomena and Magnetron Discharge in Electrical and Electronic Equipment, St. Charles Hotel, San Diego, Calif.
- Oct. 30-Nov. 1-Annual Convocation Southwestern Airport Managers Assn., Ramada Hotel, Riverside, Va.
- Oct. 31-Nov. 1-1951 Electron Devices (Continued on page 9)



PROBLEM: To pump and proportion a fuel, an oxidizer, and a corrosive diluent in a single unit.

SOLUTION: SUNDSTRAND'S MULTI-LIQUID PUMP

...which delivers precise proportions of three such liquids, accommodates widely varying inlet pressures and produces discharge pressures of over 3,000 psi. Capable of operation at shaft speeds from 1,250 to 2,500 rpm, overall efficiency at rated flow and pressure is demonstrated to be over 75%. Combined maximum capacity of the three fluids is over 40 gpm per minute. It also incorporates a small fixed displacement piston pump which can deliver another fluid at a nominal fixed output of 1 gpm per minute.

The pump contains three one-piece pistons with three stepped diameters (see sketch) and displacement is controlled by varying the mesh plate angle with an electro-hydraulic servo valve (pictured).

The presence of the vent diaphragm is practical to handle fuels and oxidizers in the same pump body. The inert fluid is interposed between the two reactive fluids so that direct leakage of one into the other is prevented.

Do you have an application for a pump that will handle several fluids in a single unit? Or perhaps you have a measuring or proportioning problem that Sundstrand engineers can solve. For detailed information or test and experience in small pilot-scale pumps, write to:

Manager, Application Engineering



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If you would like to work at Sundstrand, in Denver, finding practical solutions to challenging problems, write to our Personnel Director.

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DB25



IN USE AT A NAVY LABORATORY FOR A FULL YEAR

A year ago, the Naval Research Laboratory tested a new data processing system with a new concept. The Burroughs-initiated DB25 modular miniature computer. The factors that resulted in the installation of this system for the Navy are the many advantages of this modularly constructed system which enjoy advantages.

1. Programming. The built-in assembly programming, now available through its computer, because it is a completely variable structure, length, as relatively low cost, its program for simplified storage, then, and its capability for using the Navy's sophisticated command and control language (The DB25 has a built-in error, and correction which are integral part of its software complement).

2. Reliability. The DB25 passed rapid Naval acceptance tests. Partially, it was not so demanding that it is able to operate at protected speeds of 100°C and under its life, even from power failure, without interruption loss.

Proving its reliability in the job over the past year.

The DB25's highly sophisticated complex of modules is designed to permit up to four computer modules, each with an integral 1024-bit memory, and up to ten input/output modules, to fully share the expandable memory of 4,096 to 41,943 words.

An executive program called user Automation Operating and Scheduling Program manages the system modules, hence, major advantages. It provides a self-contained and real-time response. It enables the system to automatically schedule itself and assure maximum efficiency. It tracks the system in automatically diagnosing and bypassing its own malfunctions so that it cannot be totally disabled by a single system failure.

For further details, write for an folder, Burroughs-Milwaukee DB25 Modular Data Processing System. But, for just let us prove that system's greater efficiency for real-time, high reliability availability applications for you. Write: Delmar and Steve Green, Marketing Division, Burroughs Corporation, P.O. Box 1000, Piquette, Pennsylvania 19370.



Burroughs Corporation



DB25 modular miniature computer system

AEROSPACE CALENDAR

(Continued from page 7)

Meeting, Institute of Electrical and Electronic Engineers, Sheraton Park Hotel, Washington, D.C.

Oct. 16-Nov. 2-Full Quarterly Regional Meeting, Assoc. of Lord Transport Airlines, Royal Hawaiian Hotel, Honolulu

Nov. 16-International Air Safety Seminar, Flight Safety Foundation, Adams, Grant, For 150 members and by invitation

Nov. 16-Vehicle Design and Production Meeting, American Institute of Aeronautics and Astronautics, Fort Worth Convention Center, Wright Patterson AFB, Dayton, Ohio (Classified)

Nov. 16-Northeast Electronic Research and Engineering Meeting (NEREM), Institute of Electrical and Electronics Engineers, Commonwealth Academy/Science Hall, Boston, Mass.

Nov. 17-17th Institute on Air Traffic Control Management, For information, Dr. Morris L. Felt, Director, Transportation Planning, The Aerospace Corporation, 1001 151 St. N.W., Washington D.C.

Nov. 17-17th Regional Meeting in Studies of Navigation, August Mullen Hall, Los Angeles, Calif.

Nov. 18-Annual Meeting and Exposition, Society for Experimental Stress Analysis, Sheraton Hotel, Boston, Mass.

Nov. 18-Symposium on Superconductivity, London, England, Specialist Book Club, French and U.S. Air Line Pilot Association

Nov. 18-24-Symposium on Automatic Check-out Equipment and Techniques, Columbia Univ. Corporation NAA's Group, Marshall Space Flight Center, Huntsville, Alabama (Classified)

Nov. 18-24-Symposium on International Control Systems, Pan American N.E. Scientific and Technical Liaison Office, Air Force Systems Command's Research and Technology Div., Bureau of Naval Weapons (Classified)

Nov. 18-24-South Atlantic Symposium, Society of Aerospace Material and Process Engineers, University of Florida, Gainesville, Fla.

Nov. 18-24-Symposium on Composite Materials, Structure, El Paso Text Seminars, Texas Western College, American Meteorological Society, AIAA

Nov. 18-24-4th Annual Meeting, Association of Astronautics and Astronautics, American Institute of Aeronautics and Astronautics/NAA's Flight Research Center, Edwards AFB, Calif.

Dec. 1-4-19th Engineering Symposium, Institute of Electrical and Electronic Engineers, National Motor Hotel, Washington, D.C.

Dec. 3-4-4th Annual Seminar on the Role of Space Vehicle Systems in the Electrical and Electronic Systems, Air Force Materiel Command, Los Angeles

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broadest line
of Military
silicon power
transistors
in the industry

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US2N1424	US2N1401
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US2N1702	US2N1403
US2N1704	US2N1404
US2N1706	US2N1405
US2N1708	US2N1406
US2N1710	US2N1407
US2N1712	US2N1408
US2N1714	US2N1409
US2N1716	US2N1410



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Martin techniques for solving the problems of life support in space

1. In Martin equipment studies, we test safety and operation of protective clothing in environmental control chambers which provide a wide range of temperature variations. Mounted over a variable speed variable pitch treadmill, the chamber checks equipment under conditions of exertion as well as repose.

2. In Martin simulators, we put men through rigorous computer programmed "flights" which duplicate every condition of a space mission but neglect one: Purpose. To evaluate man's performance under these conditions and to verify the sub systems he needs to assure completion of his mission.

3. In Martin life sciences laboratories we are developing and testing reliable systems for man's living in a breathable atmosphere. Shown here is CAPS-2, a fully instrumented Photosynthetic Gas Exchange Unit being established in the post-flight goal of a space vehicle for actual test in space. Successful test flight took place in March 1962.

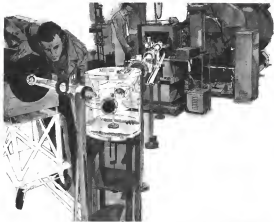
4. In Martin design studies, we conduct detailed tests for optimum control cabin configuration. Pilot shown here is running a simulated human loading problem with an on place diagram of line possible control panel arrangement.

5. At Martin's Biomedical Laboratory, we use full scale computer programmed simulators to develop precision techniques for endoscopic of orbital spacecraft. Triple exposure shows progress of spacecraft making approach and closure for docking under a simulated space conditions.

These are just five examples of the techniques we use to provide answers for life support in space, where man is the prime system. Current Martin research includes the basic life sciences, the development and application of equipment and instrumentation, the chemistry, physics, metallurgy and mathematics of life support, and the entire broad area of Man-Machine integration. Our extensive range of facilities and capabilities gives us the unique opportunity to integrate all aspects of the problem. Life support is an area of super capability at Martin.



MARTIN MARTIN
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...to count a little
Bremsstrahlung...

When electrons impact against the skin of an orbiting satellite, a shower of radiation known as *Bremsstrahlung* is issued inside the skin. By laboratory measurement of such showers of energy, scientists can determine the effect of the radiation belts through which the satellite is passing — important information for America's men in space program.

Using their Van de Graaff accelerator, scientists at the LTV Research Center have produced a homogeneous beam of electrons which reproduces an important facet of the environment of a radiation belt in space. Working closely with Dr. James Van Allen, they have used this beam to calibrate detectors now in orbit, permitting the satellite signals to be evaluated. This important company-funded project is similar to the work performed by LTV in establishing the calibration of the radiation detectors on other NASA projects including the Mercury capsules.

In meeting this exciting challenge, LTV again demonstrates the engineering ingenuity and scientific versatility which have won it a position of leadership in America's space and electronic industries. LTV Research Center, Long-Torco-Vought, Inc., P. O. Box 5003, Dallas 22, Texas.

LTV LEADERSHIP THROUGH VERSATILITY



Designs ... for NASA and Corps of Engineers

Apollo, Gemini, subsequent Manned Space programs — all will take their launch, flight and recovery commands from the new multi-million dollar Integrated Mission Control Center in Houston. Conceptual studies, preliminary design, detail design, construction planning — all were the assignment of Kaiser Engineers. Today, KE is designing other aerospace projects — including NASA's Space Propulsion Facility in Ohio — combining the skills of professional engineers and experienced builders for any phase of a project from design through construction, operation and maintenance. KE proudly includes among its clients NASA, AEC, Army, Navy, Air Force and aerospace industry firms.

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Tough guy

The toughest proving ground for any aero engine is an trainer aircraft, where the Bristol Siddeley Viper gas turbine made its reputation. In seven years Viper-powered trainers have entered service in six Air Forces of the world. Add to this the fact that Vipers have also featured in nine other types of aircraft including conversion, research aircraft and fighters and you have world-wide proof of ruggedness and reliability.

The sheer simplicity of the Bristol Siddeley Viper is the basic reason for its reliability and ease of handling. It has also been a major factor in the rapid development of the engine from its original rating of 1,375 hp. The latest version, the Viper 30, is rated at 3,000 lb thrust and

powers the Hawker Siddeley 135 and the Pegasus Douglas PD 808 convertibles. The engine is now under development to even higher thrusts.

An extensive service organisation exists for the benefit of the operators of Bristol Siddeley engines and full servicing facilities are available throughout the Americas.

Bristol Siddeley Engines Limited Aero Engine Division, PO Box 8, Filton, Bristol, England.



BRISTOL SIDDELEY SUPPLY THE POWER

GETTING HERE IS ONLY HALF THE JOB

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Performance in the last critical second means the difference between success and failure . . . and performance is what we sell at Sperry Farragut.

Here, Target Detection System Capability goes hand in hand with our broad experience in the Guidance and Control Field.

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The MCDONNELL 188E*

A True STOL Transport for the tactical assault operation should exhibit the capability for carrying mission loads into and out of forward dirt strips of minimum length and degree of preparation without the sacrifice of range or safe handling characteristics.



The McDonnell 188E is the only transport in the Western Hemisphere capable of carrying an eight-ton payload 500 nautical miles, landing safely with less than 500 foot ground roll on a 1,000-foot dirt strip and returning to its base of departure, with payload, without refueling.

Over ninety per cent of all the wheeled and tracked vehicles of a ROAD airborne

division, including the 2½ ton military truck, can be STOL'd by the McDonnell 188E. Yet the 188E with its unmatched STOL performance is small. It has a wingspan of only 76 feet.

Typical McDonnell 188E performance has been demonstrated on the prototype, the Bequest 941. Ask the Officers who have flown it.

MCDONNELL

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The Aircraft of Bequest 941



Radio 12 Channel 540 Degree Multiplex Set

Cleared for take-off...

Industry's only solid state multiplex equipment designed expressly to meet airborne military specifications

Now, for the first time, solid state multiplex equipment has been designed from conception to meet the requirements of MIL-E-5450 and MIL-S-1720. This equipment is now available in basic 12-channel "building blocks."

Compact, lightweight and designed to rugged airborne specifications, ECI frequency division multiplex equipment is ideal for use in any air transportable, mobile or sleeping system — wherever weight and space and performance are prime considerations.

[A typical application is the 50-channel AN-MCQ 3, now in production by ECI for the U S Air Force. It is 1825 pounds (72%) lighter and 60 cubic feet (67%) smaller than functionally identical existing military equipment.]

The new multiplex equipment, capable of handling voice, teletype or high speed data, is the result of company-sponsored R&D by Electronic Communications, Inc. ECI has taken full advantage of latest developments in the state-of-the-art—redundant circuitry, miniature 5-bar diodes, high density cardboard packaging, and solid-state chassis throughput. The result is a highly reliable multiplex system that—in its basic 12-channel format—occupies only four cubic feet and weighs only 150 pounds. Channel quality meets the highest standards.

The ECI multiplex set can provide high volume channel capacity through stack up of the basic 12-channel modules. In any application, equipment may be grounded to fit available space.

Write today for details and specifications.



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COMMUNICATIONS, INC.**
P. O. Box 12208, St. Petersburg, Fla.
Telephone 347-1111

- ☐ Please send me free general information and specifications on the ECI multiplex system.
☐ Please send me specific details on a _____ channel multiplex system.

Name _____
Title _____
Company _____
Address _____
City _____ State _____
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Volume 29
Number 14

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SPACE TECHNOLOGY

KENNEDY'S OFFER STIRS CONFUSION, DISHAST

ISS, MISSILE EFFORTS KEYS TO BOULKOW SPACE ROLE

Tracks of Accord Seen in U. N. Space Report

Standard Space Guidance System Controversy

Next Vehicle Estimates Changed

Rockwell Space Shuttle Reductions in Rocket Case Weight

X-Rays Detected by Astronauts

Lockheed Saturn Plant Near Completion

AIR TRANSPORT

WIDE GAP SEPARATES CARRIERS ON FAIR CUT

MEDIUM-RANGE CONCORD MAY BE DROPPED

Companies Plan SST Risk Sharing

Northeast Flying Revealed Unlikely Despite Merger Offer

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AVIONICS

APOLO'S OPTICAL-INERTIAL GUIDANCE DETAILED

NEW HORIZON SENSOR PLANNED FOR ADINA S

Inertial System Uses Electrostatic Gyros

West Ford Report Notes St. Rose Polaris

Filter Center

AERONAUTICAL ENGINEERING

EDWARDS PROPOSES LARGE FIVE-YEAR PROGRAM

Heavy Turbine Propellers Overhauled at Shaw

Production Shifting

MANAGEMENT

IMPACT OF DEFENSE SHIFTS EROD

SENATE REJECTS ECONOMY MOVES, PASSES DEFENSE BILL

Nuclear Tests Affected by Test Ban Treaty

Congress Seeks Prevention of Cruise Weight Stock Purchase

Industry Cleanse

Who's Who

BUSINESS FLYING

BECH REPORTS 15 FIRM KING AIR ORDERS

Mitsubishi A6A-2 Begins Test Flights at Nagoya

EDITORIAL

Kennedy's Space Reawakening

COVER: Boeing 727 short haul, air-masted jet transport in United Air Lines livery, in

shown during a test flight conducted by Boeing. This is the work aircraft first fitted to call

all the passengers back out of a total order of 40 by the carrier. The first 727 will be

delivered to United by the end of October and will be equipped with 100 seats. Flight

plans are Delta Flight 1, Boeing 730-1, Boeing 730-2, Boeing 730-3, Boeing 730-4, Boeing 730-5, Boeing 730-6, Boeing 730-7, Boeing 730-8, Boeing 730-9, Boeing 730-10, Boeing 730-11, Boeing 730-12, Boeing 730-13, Boeing 730-14, Boeing 730-15, Boeing 730-16, Boeing 730-17, Boeing 730-18, Boeing 730-19, Boeing 730-20, Boeing 730-21, Boeing 730-22, Boeing 730-23, Boeing 730-24, Boeing 730-25, Boeing 730-26, Boeing 730-27, Boeing 730-28, Boeing 730-29, Boeing 730-30, Boeing 730-31, Boeing 730-32, Boeing 730-33, Boeing 730-34, Boeing 730-35, Boeing 730-36, Boeing 730-37, Boeing 730-38, Boeing 730-39, Boeing 730-40, Boeing 730-41, Boeing 730-42, Boeing 730-43, Boeing 730-44, Boeing 730-45, Boeing 730-46, Boeing 730-47, Boeing 730-48, Boeing 730-49, Boeing 730-50, Boeing 730-51, Boeing 730-52, Boeing 730-53, Boeing 730-54, Boeing 730-55, Boeing 730-56, Boeing 730-57, Boeing 730-58, Boeing 730-59, Boeing 730-60, Boeing 730-61, Boeing 730-62, Boeing 730-63, Boeing 730-64, Boeing 730-65, Boeing 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EDITORIAL

Kennedy's Space Boomerang

President Kennedy has dealt his own national space program its heaviest blow. This extraordinary feat of political courage was achieved with his recent United Nations speech appealing to the Soviet Union to share this nation's effort in a joint program to land men on the moon (see p. 26). No matter how hard the White House apologists try to recast recent history, this speech represents a basic shift in U.S. space policy that is having political support for the program and linking much of the technical momentum already achieved. It is also a good example of the brittle brilliance of the White House staff members who spawn soundbites and are not much thought on their manifestations and are not usually surprised by the fires they ignite.

Immediate Effects

The immediate effects of the President's ill-considered invitation to the Soviets to join the U.S. Apollo program are twofold.

• First, it will provide congressional opponents of his space program with the well-sharpened axe they need to cut its Fiscal 1964 budget drawbacks and retard U.S. space program even more than the restrictions of tech need development. It has changed the Fiscal 1964 NASA budget bill from an essential instrument to achieve a top-priority national goal essential to the nation's security and international leadership into what was easily construed by its opponents as a Russian foreign aid bill. It also leaves the congressional supporters of the President's space program with neither administration credibility to defend it successfully.

• Second, it will induce a psychological drug into the rest program that has just begun to build promising technical momentum. It may change the motivation of several million Americans who are involved in all phases of the manned space flight effort from a patriotic sense of extreme urgency to a routine 9-5 job in which the fruits of their labor may be reaped in the Soviet Union.

The long-term effects are difficult to preview in detail, but there is little doubt that the manned space flight program faces the prospect of dwindling from one of the most exciting challenges ever accepted by a nation to an unimportant game in the cold war to be sacrificed in the first grab of appeasement.

There are certainly many indications that the Soviets are finding the current U.S. pace in space technology a major challenge to their present claim of international leadership in this vital area. During the period of their unquestioned leadership they were not interested in exchanging any technical data on their manned space flight programs with anybody. Now that they are losing the punch, they are making overtures to tap U.S. techology.

To understand just how the Soviets view technical exchanges, it is worth recalling the few experiences in the aerospace field of recent years.

Audis Tapscott was shown the modern Convair plant at San Diego, then producing F106 supersonic interceptors, and the Douglas plant, where Thor ballistic missiles were being built. When USAF brass visited Moscow they were shown the two oldest aircraft factories in Russia—one producing jet engines of British design, and the other, Sergei Ilyushin's versions of a Convair 440 transport. Who benefited most from that exchange?

Aeroflot Visit

When an Aeroflot delegation visited the United States as a preliminary to negotiations for a bilateral air transport agreement, they were given a thorough look at U.S. airline operations, including inspection of a modern jet overhead operation. When the U.S. group arrived in the USSR for reciprocity, they were shown access to any jet engine overhaul facilities and shown many open houses and bulletin boards for airline operations. Who benefited most from that exchange?

The Soviet contributions to international space technology gatherings in recent years have been varied and inconsequential compared with the data that they have obviously garnered from their pioneering efforts.

The slack of the President's loose landing policy reversal has not yet been fully felt, either technically or politically. This cannot set that could divert the purpose of a vast technological effort and billions of taxpayers' dollars in attempting to create a fleeting political impression that certainly cost gave doubts as the sincerity of many other phases of the Kennedy Administration's program.

—Robert Hata



INDUSTRY BEST

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FM MAG TAPE ELECTRONICS PERFECT?

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FM electronics for instrumentation tape recorders have always lagged behind the design excellence found in tape transports and heads. Probably because the design errors came from electro-mechanical couplings.

New Vidar tape electronics are the product of specialists in the field of voltage-to-frequency conversion. Repeatable measurements of significantly superior specifications. Vidar offers five times better linearity and 36 times better long-term drift than the best of the five leading tape recorder manufacturers.

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Record or reproduce amplifiers can be interchangeably installed in the same rack housing providing both total savings and flexibility. As shown above, a convenient calibration module permits front panel calibration in less than 30 seconds per channel (only center carrier need be set, no full scale adjustment is necessary).

What about a tape transport? The tape recorder you now have may be entirely satisfactory if you replace the old electronics. For new installations, you can have the pick of several fine transports. Vidar FM record/reproduce amplifiers are compatible with all conventional instrumentation transports. Vidar will take system responsibility for the marriage.

For more information, please call your local Vidar sales representative (listed in *enr*), or contact us at 77 Ortega Avenue, Milpitas, Calif. Phone (415) 961-1000.

VIDAR

WHO'S WHERE

In the Front Office

Mike F. McCausland, assistant group or senior responsible for The Radio Corp.'s Edison/Power and Radio Frequency divisions (Teterboro, N.J.), President Dev (South Mountain, Pa.), Power Control Div (Bloomington, Ind.).

Joseph E. King, New York leader, chief of a branch of Space Radar Corp., replacing George M. Binkley, president of Metro-Matrix Corp., who has resigned.

Frank C. Hubbs, formerly with Texas World Airlines, now made vice president of Radio Electronics Inc.

Walter W. Stinson and **Nathan Cohen**, directors, Radio & Northrup Co., Philadelphia, Pa. Mr. Stinson is president of International Business Co., Mr. Cohen, LBN's vice president/technical affairs.

Dr. Robert E. Tanner, a director TRG Inc., Mount N.Y., he continues in a vice president of TRG and general manager of TRG West.

Barclay S. Shalensky's appointment to the board of British European Airways has been obtained by the Minister of Aviation (U.K.) to Oct 9 1968. Mr. Shalensky is chief executive of BBA.

Richard E. Brown, president and chief executive officer of Sikorsky Transport Corp., Cranston, N.Y. Arnold Moore has resigned as board chairman.

David W. Brown, senior vice president/long-range planning, General Data Systems Corp., Glendale, Calif. and Jennings & Clark, vice president/general manager.

Robert McKee, vice president/general manager, Transairline Inc., Gardena, Calif. **Bryan Stark**, executive vice president and general manager, The Nyack Corp., Nyack, N.Y.

Walter A. Pitzer, executive, Radio Electronics Inc., San Diego, Calif. **Ferry E. McCarty**, executive, Radio Electronics Inc., Fallbrook, Calif.

A. M. Kerner, corporate controller, Laboratory Electronics Inc., Boston, Mass. **Albert W. Harrison**, board chairman, Radio Electronics Manufacturing Co., Mansfield, Ohio. **Frank C. Fox**, secretary, M. Shalensky is president.

Robert H. Miller, president, Radio John Chaffin, N.J. is a director of General Systems Transportation Corp., succeeding S. K. Kohn, retiring.

Harold F. O'Brien, vice president/marketing, Brown Electronics, El Cajon, Calif.

Changes

L. T. Grooms, manager of program control, Air Weapons Systems, General Dynamics/Astronautics, San Diego, Calif. **Nic F. A. Symington**, chief operating principal, CDA.

Henry F. Stinson, Jr., assistant to the director of marketing, Systems Support Dept., Northrup, a division of Northrup Corp., Anaheim, Calif.

Robert E. Atchley, former president of Sikorsky Transport Corp., now director of marketing for the Electronics Group at Thompson, Sanson Wadsworth, Inc., El Segundo, Calif.

(Continued on page 101)

INDUSTRY OBSERVER

► Competition for a lightweight carrier launch vehicle (AW July 1, p. 17), which would be carried piggyback to the remote surface by the Saturn launch spacecraft, has been narrowed by Jet Propulsion Laboratories to three contractors—General Motors and Radio Corp. of America, American Machine & Foundry with General Electric, and Bendix. JPL engineers have recently accepted these companies' facilities. Two parallel studies are planned.

► North America's Space and Information Systems Division has invited interested companies to participate in studies of the current and associated mission requirements for the CLAM (low-cost low-altitude aircraft), which NASA and Lockheed are studying separately for the Air Force. North American has asked the firms to submit an effort on a nonexclusive, non-binding basis. CLAM probably would be carried in the mid-highspeed, low-endurance aircraft (Daguer) under review by USAF (AW May 6, p. 33).

► Revised NASA plans call for a manless carrier to be a transporter to be carried by both the Apollo command module and the Lunar Excursion Module (LEM) to enable the command module, if necessary, to search for outposts of LEM. The manless carrier will be supplied in Radio Corp. of America, but the landing (Daguer) carrier will be provided by RCA in an industry competition.

► Army is expected to select one of the military-supported, non-profit organizations which intend the services to conduct the Polaris and Redstone tests. The Redstone and Redstone dual-fired anti-aircraft missile for helicopter anti-air use. Also, General Dynamics probably will be asked to study the feasibility of adapting or modifying Redstone, which it is developing for the Army and Marine Corps, as a helicopter anti-air weapon. Although planned by development program (AW Dec. 24, p. 19), Redstone recently installed down a down helicopter in tests at the Naval Ordnance Test Station.

► Radio atmospheric satellite which would orbit the earth about the atmosphere and observe radio waves from the ionosphere at the Orléans Air Force Station (OASD) is planned to observe radio waves under consideration in Coldwell Space Flight Center as a possible future program.

► Lockheed Missiles & Space Co. is evaluating proposals for flight posture active electronic countermeasures (ECM) for use on the Navy's Polaris A-3 ballistic missile. The equipment would be used to jam enemy radar during warhead re-entry. Previous active ECM systems designed for the Polaris A-1 by Lockheed Electronics and Raytheon encompass limited Polaris flight testing to determine only whether the jam was operating during the covered descent path.

► USAF's Aeronautical Systems Division and NASA are negotiating an agreement under which a Lockheed C-130 transport would be taken off the production line and fitted with Gears and Gears cockpit displays. The aircraft would be used in evaluating instrument displays with spacecraft concepts in zero-g trajectories.

► Navy BuWeps is expected shortly to issue proposal requests for studies of the feasibility of an investigation of ship-mounted reconnaissance, communications, weather and countermeasures probes for local fleet support. Although the studies are not definitely linked to the Taurus missile, it is likely that the weapons system will serve as the host vehicle for the special payloads.

► USAF's Space Systems Division is studying the possibility of conducting launch control and tracking facilities at Vandenberg AFB, Calif., and the remainder of the Pacific Missile Range to minimize duplication. SSD is surveying potential contractors which might assist in the studies.

► USAF is preparing two Vega Hotel medium explosion detection satellites for launch aboard an Atlas Agena vehicle next week, from Cape Canaveral. The satellites will be launched into a 90,000-mile circular orbit (AW May 28, p. 20).



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Exercise Big Lift

Washington Roundup

Exercise Big Lift—lifting the Army's 2nd Assault Div. from Ft. Hood, Tex., to Germany in late October—is laden with political, military and economic significance for the aerospace industry.

Some congressional bodies are the extreme or unaffair choice to demonstrate that it makes sense to bring more U. S. troops home from Europe and rely instead on our growing air and space capabilities. Chairman Richard B. Russell of the Senate Armed Services Committee goes so far as to suggest that this exhibits politics bringing home our Europe-based divisions annually for the next five years.

Chairman George Malone of the House appropriations subcommittee which handles the Defense Dept. budget cautions that this idea is attractive, but cautions that the U. S. must somehow avoid the serious psychological impact such a step would have on North Atlantic Treaty Organization allies. Rep. Michael Rivers, whose House Armed Services subcommittee examined U. S. airlift potential extensively, feels it is high time to stop worrying about our allies' feelings and do the sensible thing. He said Big Lift "will certainly give us a reading" as to what degree the U. S. can substitute airlift for pre-positioned troops. The concept was tested with a smaller group in the Long Thrust 2 exercise (AW Mar 19, 1962, p. 17).

McNamara's View

Defense Secretary Robert S. McNamara said Big Lift "will be the first exercise to link up a major U. S.-based land force with combat (aircraft) positioned overseas ready for action and... this capability for rapid reinforcement presents a new magnitude of U. S. military requirements." Military officials add that the heavy use of such "variable assets" as Lockheed C-130s in the exercise will further obscure the fast link between tactical and strategic airlift.

About 200 C-119s, Boeing C-119Bs and Douglas C-119Bs, C-119As and C-119Cs will transport the troops overseas. Tactical airlift will fly direct from the U. S. and be needed en route by Strategic Air Command's Boeing KC-135s. Aereo estimates the total cost of the exercise at \$30 million. This compares with the Army estimate of \$125 million for maintaining one division in Europe for a year.

Several aircraft company officials feel Big Lift will provide the long sought yardstick for measuring airlift costs against those of pre-positioned troops. Industry opponents predict the airlift will suffer opposition in allocating an even larger portion of the defense budget to airlift assets, while others lament the fact that the real savings cannot be shown until such modern transporters as the USAF-Lockheed C-141 go into service.

NASA Reorganization

Dr. Elmer E. Newell, director of the Office of Space Sciences, looks like the big winner in the latest National Aeronautics and Space Administration reorganization. Under the plan now getting its final touches, the present five technical offices would be consolidated into three others managed by Newell, Dr. Raymond Bragg and Dr. George Mueller. Space sciences, under Newell, would absorb two more programs—spacecraft studies and tracking—while Mueller would direct all manned flight and Earth-orbiting research and advanced research programs. Each would be elevated to associate administrator for his respective program, and a patch under Dr. Robert C. Seamans, Jr. who is associate administrator and general manager of the agency. NASA's research center will report to the three associate administrators. Stated purpose of the agency's third major reorganization is less than three years to give program managers more authority and clarify the line of authority and relationships between headquarters and the centers.

USAF's Midos Plans

Air Force is trying to convince skeptical civilian opinion that enough improvements have been made in the Midas early warning satellite to justify funding for production prototypes. Aerospace Corp. recently took over management of the Midas program from Lockheed Missile & Space Co.

Newly formed House Armed Services research subcommittee will focus soon on military use of nuclear reactors, both for power and propulsion. Chairman Melvin Price's subcommittee has received broad explanation of most of the military research program and now is about ready to go into line items. Rep. Price will ask Army, Navy and Air Force research chiefs to stand hearings over the next several days whether they feel Defense Dept. is spending enough on promising nuclear projects.

Rep. Jim Fulbright, a key Republican on the House space committee, had this comment on President Kennedy's proposal for joint U. S.-Soviet space efforts (see p. 16): "Instead of trying to get NASA together with Russia, they should try to get NASA together with Congress. We'd make a great team."

—Washington Staff

Economic Impact of Defense Shifts Eyed

By Katherine Johnson

Washington—Congress and the Administration are now giving high-priority consideration to the impact of \$53 billion-a-year defense spending on the economy and the impact of drastic shifts in this spending on defense industry.

In the background is a recurring concern over the stagnation of the civilian sector of the economy and the prospect of disarmament raised by the inter national nuclear test ban agreement.

The first comprehensive series of congressional hearings on the economic consequences of defense spending will start in November. They will be conducted by a Senate subcommittee on manpower and employment, headed by Sen. Joseph Clark (D-Pa.) and last month. Then will come consideration of the problems of labor and unemployment in defense industries, the effect of the military program on the overall economy, growth, and the adaptability of defense industries to shifts in military requirements or disarmament.

Interagency Group

The Administration's effort is being coordinated by an interagency group under the President's Council of Economic Advisors, now being organized after an initial meeting. The group is headed by Gardner Ackley, a member of the council. Its membership will include representatives from the departments of Defense, Commerce and Health Education and Welfare, the Atomic Energy Commission, Arms Control and Disarmament Agency, and the Small Business Administration.

The new approach taken by both the Clark and Ackley groups is to consider conflicts resulting from changing military requirements or from possible disarmament in the future, as well as problems arising from a test ban agreement.

LEM Bids Due

Bids are due at Commerce Dept. Engineering Corp. Sept. 19 on the next contract for design work for the Apollo Lunar Excursion Module.

The LEM supported gun system is divided for trials-two for oxygen and two for hydrogen. Both the hydrogen and oxygen units had the full test and the important design is available as a source of oxygen for the astronauts. A supported gun is one that is mounted on a homogeneous base, neither nor platform, fixed on completely ground. Companies expected to submit bids include: General Electric, Aerojet, Bell Aircraft Corp., Bendix Products, Boeing Div., Philco Aircraft Co. (owned by Arthur D. Little, and Los Angeles), and Union Carbide. Value of contract is estimated at \$4 to \$5 million.

The arms control agency is the new future is expected to let contracts for expert study on how both industry and regions can adapt to defense shifts. The electronics industry, said Healy, be the corner piece for the industry study.

A working group, under the chairmanship of Arthur W. Belzer, deputy assistant secretary of defense for arms control, is now in the process of obtaining industry thinking on economic adaptation. Alexander and Steelman are the other members. Liaison members are Karl Hart, president of Aerospace Industries Assn., James Secret, executive vice president of Fibers Division, Inc., Robert McLean, director of National Security Industrial Assn., Charles Sorenson, president of Marmon & Allied Products Institute, and John Gossman, executive assistant to the president of AFL-CIO.

Industry Witnesses

The Clark subcommittee hearings will be in two phases. The impact of defense on the industrial sector will be dealt with in the third phase. Representatives from three areas will be called to testify: industries, such as aerospace, almost wholly devoted to defense industry, and industries, divided, between civilian and defense business, and industries participating in defense work but primarily concerned with commercial production.

Reports that financial support for commercial planning and research for commercial production should be provided in major defense contracts have strong support in the subcommittee.

The first phase of the hearings will focus on the impact of defense on power resources. The fact that rapidly changing technology is now requiring

ASROC Study

New England attempts to boost capabilities of the ASROC system is a shipboard anti-submarine weapons are being investigated by Naval Ordnance Test Station, China Lake, Calif.

One concept under study is a stream of small, expendable torpedoes which would be launched through only a single orifice on about 10 mi. in attack radius high speed nuclear submarine capable to the U. S. Navy's Surface.

The Mark 46 missile, torpedo, which will be ready soon for testing with the ASROC, should be effective against slow moving submarines, the Navy believes. The Mark 46 will remove the overall efficacy of the current ASROC. The Mark 46 is expected to be a test of this.

an individual to undergo fire or its training program and spend to maintain jobs during a lifetime will be considered. The effect on overall economic growth of concentrating scientific and technical manpower in the armed services and defense industries will also be reviewed.

A key witness in the phase will be Dr. Herbert Wagner, director of the White House's Office of Science and Technology, who has been warning since the past year that in economic competition, the U. S. is falling behind Japan and European countries, which are spending more on technological research and development.

What the government did or should have done to help solve the problems of manufacturers but, major defense contracts will be the subject of the next phase of the hearings. Individual testimony will be received on the War, the, Kim, and the San Diego, Calif., and the Long Island, N. Y., area, and the state of Michigan.

The fourth and final phase will be an evaluation of all the preceding testimony, with an eye to taking action to avert the problems raised. It is hoped that many of the problems will be solved in a series of hearings brought to light and recognized. But Clark also expects to present congressional legislation or a series of legislative proposals for consideration next year as a result of the hearings.

Aspects of the defense industry's control, as economic adjustment and disarmament were expected by two leaders, but not.

David H. Houghton, parliament, Lockheed Aircraft Corp., also noting that aerospace stocks dropped when the nuclear test ban agreement was announced, Houghton shared in a speech in the Arms Society of Southern Africa.

"The U. S. proposed to the 17-nation disarmament conference in Geneva last year behind 15 steps. Each step will be agreed and funded. Some may never be achieved. It is important that we have a period of time, much longer, before our nation could begin increasing defense and other activities to a point that would seriously affect our progress at Lockheed."

"How can we do this? Well, our principal work involves major systems and articles made in limited warfare, suppressing weapons, surveillance and inspection, push defense operations, and creating and the latter are a continuing work on our atmosphere."

"It is conceivable that defense needs may, shaken or somewhat. We don't think it will happen soon, and we don't think it will happen at all. But that doesn't mean we shouldn't... prepare ourselves for it."

Nuclear Tests Affected by Treaty

Nuclear testing in the atmosphere, underwater and in space is limited by the international treaty ratified by the Senate last week. It is in fact signed by over 100 countries, more than was negotiated by the U. S., U. K. and USSR. Underground testing is exempted from the ban. U. S. estimates it will be possible to test weapons up to one megaton yield in this manner. Below is an indication of the Senate Foreign Relations Intelligence Subcommittee of the type of tests that will be legal and illegal under the treaty.

Test Character	Allowed under treaty
Survivability and responsiveness of hardened site mobile launch systems to high yield nuclear explosions	No
Response of hardened underground structures to blast and outgassing from high yield nuclear surface weapons	No
Response of hardened underground structures to ground option	Yes
Destruction of ocean, water-based and oceanic vulnerability to nuclear explosions during atmospheric warfare	No
Reduction of oceanic water-based and oceanic vulnerability to nuclear in place	Yes
Study of atmospheric and high altitude color blackout phenomena	No
Study of micrometeoroid blackout phenomena from high yield nuclear explosions	No
Effect of operational tests of MIRV systems	No
Development of MIRV vehicles with oceanic, ballistic and oceanic ballistic properties	Permits
Development of very high yield warheads, equal to or exceeding Soviet advanced warheads	No
Demonstration of very high yield nuclear weapons effects	No
Demonstration of underwater nuclear weapons effects for improved air submarine warfare systems	No
Displacement of weapons requiring less favorable current than present design	Yes
Development of pure fission warheads	Yes
Development of nuclear fission weapons	Yes
Full-scale performance and reliability tests of Minuteman and Titan warheads	No
Yield reduction tests of stockpiled weapons up to approximately 1 megaton	Yes
Yield calibration tests of stockpiled weapons above approximately 1 megaton	No
Testing and crew training method exercises using nuclear weapons	No

John H. Richardson, vice president, Hughes Aircraft Co. (key contract with a large population of skilled technicians, has a significant obligation to train a select group of new products under enough to that a change of policy or thinking is now one or two decisions will affect only a fraction of the company's total effort. We have learned this over the years, and as a result we now have more than 40 distinct lines at Hughes where as recently as 1959 we had just two.

The F-111 (F-111) nuclear fighter contractors highlighted the importance for years to come of a single defense award to two major corporations—General Dynamics Corp., which won the competition, and Boeing Co., which lost—and urged the Senate to take economic adjustment measures for defense industries. It was a spectacular follow-up to testimony of the Shuford and other programs.

In the background was a persistent concern over the impact of defense on the economy as another presidential election

near year approaches. That came the nuclear test ban agreement—the only large arms treaty of the 20th century disarmament.

Fast economic planning for disarmament has been passed throughout. It has amounted to general proposals, on the claim that could be put into effect when, if ever, an disarmament agreement was achieved. These included proposals to divert defense industries to space and civilian activities, to restructure public works and rebuilding. Unlikely adjustments have been made by industry and shifts in pilot projects, a new hoped, will make disarmament planning somewhat more practicable and realistic. It will also remove the same side that disarmament planning—concerned in order to own business—has a leading edge into military equipment, weapons and nuclear employment. This case was behind the veto of the Senate Foreign Relations Committee to release last year a survey on the economic impact of disarmament made by a subcommittee.

Standard Guidance System Contenders

Los Angeles—American companies were completing training assignments and other building relationships by late last week in preparation for an Air Force competition for a series of possible, 12-month studies of a standard guidance system.

The initial IAW Sec. 12, p. 21, Sept. 21, p. 46 will provide Titan 3 studies with guidance during boost, aerial navigation, rendezvous and reentry operations to 310 months preliminary design phase in the studies.

Companies planning to submit bids to Space Systems Division for the Oct. 14 deadline include:

- International Guidance Mechanics with Westinghouse
- Minneapolis-Bloomfield with Hughes Aircraft Co. and Eastman
- Space Technology Laboratories with General Dynamics and Hughes Div. of Space Research
- IBM, and have selected by GSNF to build 1962 to supply a new guidance system for Titan 3 but the effort was awarded by Defense Dept. over Air Force selection (AWF Aug. 27, 1962, p. 27) in favor of a modified version of the Titan 3 guidance system
- Lockheed and Space and Information Systems Div. of North American Aviation
- American Bank Note Corp.
- Radio Corp. of America with assistance from unidentified subcontractors
- United Aircraft with unidentified subcontractors, possibly including Radio Corp. of America as complete supplier
- Sperry Rand Corp.
- GE Spaulding

Industry leaders want to decide at the end of the week whether it would take out of the studies.

late Sept. 24 on the fiscal 1964 defense appropriations bill.

• Sen. Everett Schwartzt (R-Miss.), ranking Republican on the Defense Appropriations Subcommittee, proposed cutting the Senate-approved \$11,765,447,000 preliminary budget for all the services another 3.5%. The House previously proposed a 1.5% reduction.

Sen. Russell, in opposing the request against leaving "increased for emphasis before the House has even voted the nuclear test ban treaty." The amendment was rejected, 49-49.

• Sen. George McGovern (D-S.D.), proposed reducing both procurement and research funds by 10%.

"I am pleading for an overall reduction in military spending on the grounds that we already possess sufficient power to deter the enemy and meet our other military needs," he said.

Also sponsoring the amendment were Sen. William McGuffee (D-Calif.) and Sen. Richard (D-W.Va.)

Proposal Rejected
Sen. Russell, in his amendment, declared it indicated "we have at least found the germ of confidence in unilateral disarmament, which can only bring the country to its destruction."

There is a strong margin of support between our military establishment and that of the Soviet Union, so far as we are informed. That this edge has maintained world peace. That fight had been provoked on being introduced. If we should take this much of the assets from our military establishment, we would still have a few military establishments. Nobody has ever set out on the second half of the world."

The amendment was reported on a 274 vote with Sen. McGovern and Randolph supporting it. Sen. McGovern and Nelson were absent when the vote was 156-60.

• Sen. William Proxmire (D-Wis.) proposed reducing Air Force research funds for the world's nuclear range ballistic missile (NMRBM) from the \$105.1 million approved by the Senate committee to the \$11.3 million allowed by the House. He argued that since the NMRBM was intended for the protection of West European air bases, they should help pay for its development. He added that the U.S. needs for mobile missiles could be fulfilled by the Nav-Loch-Lock-Palmer and Air-Mor-Mor-Palmer missiles.

Chairman John Stennis (D-Miss.) of the Senate permanent subcommittee on appropriations countered that "all of the missiles we have, that [NMRBM] to an extent has one of the most potent, at a less cost, than any of the others we have developed in this stage."

The amendment failed on a 57-72 vote.

Senate Rejects Economy Moves; Passes Defense Money Bill, 77-0

By George C. Wilson

Washington—Senate officials to the Administration and military leaders did not succeed in "imposing" by rejecting several proposed cuts in the fiscal 1964 Defense Dept. budget immediately after opening the nuclear test ban treaty, but work (see p. 25).

Only reduction made on the floor in the Senate Appropriations Committee version of the defense bill (AWF Sept. 23, p. 28) was \$11.7 million from the Army's aircraft procurement budget, a cut opposed by the defense secretary's office. The office held Chairman Russell (D-Calif.) of the Senate Defense Appropriations Subcommittee put before the bill was voted that a recent review indicated the money would not be required.

Carbine Affected

Army spokesman told Aviation Week & Space Technology that they did not reduce the cost, claiming it would threaten money set aside for additional procurement of de Havilland CV-10 Carbine 1 transports. Funding for the de Havilland CV-7A Carbine 2 would not be affected because money for these aircraft is in the research and development account. Since the Senate passed bill does not specify how the account shall be reduced, Defense Dept. leaders may decide later to come out on something other than CV-10s.

Sen. Russell, as he guided the bill through the Senate, stressed that the U.S. need not use the test ban treaty as an excuse to lower its guard. He said the price of defense will remain high for the foreseeable future. But the things that we seek to make any more feared at the bargain counter," he said.

"I have never doubted that we are not relying to get a very high annual payment on our foreign policy, so much they can rely for their security," Sen. Russell said.

Major specifically, Sen. Russell expressed determination to obtain a final nuclear test ban treaty and to keep the U.S. ahead of Russia in nuclear weapons during the test ban pending days will "not be a substantial part of money. He said support for such funds will be put in "the first year of the appropriations bill that case along."

Final passage of the \$47.98-\$47.98 appropriations bill came on a 77-0 vote. The total is \$275,000,000 less than the House voted, and \$5,675,000 less than President Kennedy requested. Differences will be resolved soon as a House-Senate conference on the two bills, pending the next few days.

House and Senate passage of the resulting compromise is the last step before sending the bill to the White House for the President's signature.

These economy amendments were voted down by the Senate during de-



Mitsubishi MU-2 Begins Test Flights

Prototype Mitsubishi MU-2 turboprop executive aircraft, which will be manufactured and marketed in the United States by Mooney Aircraft, Inc., of Knoxville, Tenn. (AWF Aug. 13, p. 37, Aug. 26, p. 38) is shown during its first flight at the Nagoya Aircraft Works of Mitsubishi Heavy Industries earlier this month. Aircraft is powered by two Turbomeca Armois 26 engines, rated at 450 hp, automatic continuous power each. Seven-place air craft will cruise at 325 mph at 20,000 ft and has a gross weight of 7,940 lb and an empty weight of 4,170 lb. Aircraft has a wing spread of 53 ft 9.5 in., a length of 33 ft 2.6 in., and a height of 12 ft 11.6 in.



Apollo Optical-Inertial Guidance Detailed

By Philip J. Klass

Cambridge, Mass.—First details on the optical-inertial guidance and navigation system to be used by the Apollo spacecraft for the major portion of its mission, from translunar injection to final earth entry, were disclosed here last week by the National Aeronautics and Space Administration.

The Apollo guidance and navigation system, designed by the Massachusetts Institute of Technology's Instrumentation Laboratory, uses a manually aligned optical sextant and a digital computer to continuously determine the spacecraft's position and velocity, and to compute therefrom the desired values. When thrust must be applied to change velocity or trajectory, an inertial platform mounting sensitive accelerometers is used to measure the magnitude and direction of the resultant change.

First complete flight guidance of the system is coming complete and is expected to begin actual tests early next year, according to a NASA spokesman. The test effort subsequent to this year are being built by first successful pilot-instruction.

• **Kilham Instrument Corp.**, is building the optical sextant and associated scanning telescope as well as a map data unit.

• **AC Spark Plug Div. of General Motors** is supplying the ground-based platform, called "inertial measurement unit" and associated display and controls and is responsible for integration of the total system.

• **Raytheon** is building the digital computer and associated display and controls for navigation and guidance functions.

• **Sperry Gyroscope** is supplying phased integrating accelerometers which mount on the stabilized platform to measure

spacecraft change-of-velocity under thrust conditions.

Because the digital computer plays a key role in the system, it is the auto checkout which is provided as a duplicate of the system automatically. The two computers are fabricated from silicon semiconductors, about 50 per cent silicon, which can be interconnected between computers. In the unlikely event that both computers were to fail, the astronauts could attempt to put one machine back into operation by connecting sub-modules from the other.

Now the top of the navigation panel and to the left, is the sextant which is used to take a star and to know the landmark on the earth or the moon's surface. By means of a small "star stick," the navigator can use a prism in the sextant to align the star with a target marked on the lunar horizon/earth landmark. When he presses a "mark" button, the angle between the two and the time of sighting will be entered into the digital computer, which will start to update constantly position and velocity data. If landmarks are not visible, a photoelectric exposure can be selected to measure the earth's horizon location instant.

To help the navigator locate the desired star within the star field and the desired landmark, a scanning telescope is provided adjacent to the sextant whose line-of-sight can be aimed through an angle of more than 180 deg. The telescope has two cameras, one providing a three-power/20 deg field of view, the other a single-power/10 deg field.

To avoid the need for the navigator to take three different celestial sights in quick succession MIT has devised a new computation procedure which can detect and compensate techniques for determining spacecraft position and velocity and predicting its expected trajectory.

Directly above the sextant and telescope is located the room for storing vast amounts of navigation and measurement data which the navigator or other crew members may need during the mission. This map and data view is an optical projection system and which one of many film magazines can be plugged, each containing thousands of frames of magnetic film data of which can be called out and displayed as needed.

The inertial measurement unit (stabilized platform) is mounted behind and beneath the sextant and telescope, but also has a control panel. The platform is a three-galvanic type which uses three flexed integrating gages.

To overcome errors during long autonomous trajectory, the platform will be shut down. When corrections are very important, an event expected to occur three times during each leg of the mission, the platform must be turned on and ground commands to its acceleration actuators will cause changes of velocity in the direction of spacecraft motion and at right angles to it. This orientation will be accomplished by use of the actuators which are attached to the inner rigid frame that supports the inertial unit, to maintain a known angular relationship between the two.

Results in initial auto-ignite tests will be available by the computer after it has calculated the required change in trajectory. Changes in velocity measured by the platform accelerometers will be fed back to adjust the operation of spacecraft guidance and the computer determines that thrust can be terminated.

During the final phase of the mission, the guidance and navigation system is designed to handle spacecraft attitude control for reentry with the astronaut using to stabilize his performance. It will control spacecraft's initial angle of attack and roll rates and subsequently will turn, roll rate to control attitude and roll and heading rate and check on the extended reentry arc. MIT says that, possibly before the voyage will be able to control the attitude of the reentry corridor to within 10 m.

The computer can communicate with the computer, to adjust desired information. By means of a small photoelectric camera and a character display to the right of the scanning telescope. By ground or air appropriate buttons or queries, the navigator indicates the action he desires, followed by buttons which indicate the subject of the action. For example, Display "Position," "Complete," "Abort Velocity."

If the computer detects an emergency situation, an emergency data which the navigator has not yet supplied, it will automatically flash an alarm and indicate the wherefrom it originates.

In response to a ground purpose parallel-type machine which can a basic word length of 16 bits, including an 8-bit parity (evenness) check. Memory cycle time is 117 nanoseconds. Single address bus is 16 bits, 16 bits, 16 bits, 16 bits, and a double precision multiple substructure takes 768 nanoseconds. Program and fixed data are stored in a high-density non-volatile tape memory which enables (reusable) data are stored in a condensed, reconvertible matrix cassette nucleus. Semiconductor microcircuits are widely used in the computer and avionics.

Twelve research awards in data to the major Apollo guidance system contractors total nearly \$85 million of which \$25 million is MIT.

Mars Vehicle Estimates Changed

Los Angeles—Revised estimates of the Martian atmosphere by scientists at California Institute of Technology and Jet Propulsion Laboratory are causing the laboratory to re-evaluate its estimates and design of an auto-vehicle, an capsule and spacecraft which should be required by the time of the first manned mission to Mars.

Revised Martian atmospheric pressure at lower altitudes lower by a factor of 10 than previously estimated. The difference between the two estimates is a factor of 10, which means that the design of the auto-vehicle, an capsule and spacecraft which should be required by the time of the first manned mission to Mars.

To overcome this difficulty, new balloons which have higher coefficients of drag and higher balloon rates may be necessary. This means that the Mars entry capsule, which should be constructed as a blunt body, will have to be made more blunt, or its frontal area will have to be increased to increase drag.

The last of these could also be increased by increasing the weight of the entry body, but this would not increase the capability of the system.

In a study of the lower pressure, the use of parachutes to slow descent may not be possible and it may be necessary to use retro-rockets to stop the probe.

The unexplained problem is believed to be one reason for a delay in NASA's plans to send an unmanned probe to the Mars Mars B spacecraft, in fact, such as it was for the Ranger and Surveyor.

Garrett Asks Court to Prevent Curtiss-Wright Purchase of Stock

Los Angeles—A federal court order will require Curtiss-Wright Corp. to prevent the Curtiss-Wright Corp. from buying a newly bid interest in the Garrett Corp. A civil complaint filed by Garrett in the U.S. District Court here charged that the Curtiss-Wright Corp. had purchased 768,000 shares—about 57%—of outstanding Curtiss-Wright stock (AW Sept. 16, p. 74) would reflect competitive in its initial product line.

Garrett asked the court to find the Curtiss-Wright Corp. and its subsidiaries, after acquisition, to be a violation of the Clayton Anti-Trust Act. Garrett also requested the court to enjoin C-W from taking any stock which would be to prevent an C-W acquisition in the Curtiss-Wright Corp. of defense, and to require C-W to report to Garrett shareholders and then tell the court under terms prescribed by the court.

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APOLLO GUIDANCE AND NAVIGATION system showing sextant (2) and scanning telescope (2) which will enable navigators to take periodic position fixes using star and landmark data stored in program display (3). Digital computer (4), provided as duplicate, will continuously compute position and velocity. Navigator can interrogate computer by means of photoelectric camera and display (5). Here, measurement will be taken of star, used to measure change in spacecraft velocity, as measured behind sextant just underneath sextant and telescope.



Elongated Jet Commander Prototype Makes First Flight

Aeros Commander's first Jet Commander prototype recently elongated with the addition of a 16-in. section to the fuselage forward of the cabin door (AVW Sept. 5, p. 25). Sept. 25, 1971, made its first flight in the new configuration at Commander's Newton, Okla., test and development facility last week. Gross weight has been increased from 34,000 lb. to 35,000 lb.

Beech Reports 15 Firm King Air Orders

By Erwin J. Reifman

Hawes-Beech Aircraft Corp. has 15 firm orders, with cash deposits, for its new King Air 250 eight-place business airplane and the company's management has authorized its procurement division to negotiate immediately the purchase of whatever Pratt & Whitney PT-6A turboprop engines, accessories and materials to provide for production of 250 airplanes.

The first King Air, a production configuration, is scheduled to fly within the next 90 days, according to Lenzie Green, Beech vice president. He said that the King Air has generated even earlier than expected development project at Beech and that the program is on schedule, with no problems in view that could change plans to deliver the first FAA-certificated King Air to retail customers by the fall of 1974.

Green said that with full equipment, including radio autopilot and all other accessories required for instrument flight, the King Air at gross weight and flying at normal cruise power will carry six people and their baggage from Houston to Detroit or New York to Miami nonstop, including fuel allowance for taxi, takeoff and climb to cruise altitude and providing for 47 min. reserve fuel.

Basic price of the airplane, with a factory interior installed, will be approximately \$100,000. Beech felt that the price of a completely equipped aircraft will be well under \$140,000.

Time of the 19th annual National Business Aircraft Assn. meeting here emphasized the rapidly growing demand for business aircraft, business aircraft, with the majority of flights and exhibit geared towards exploring the concept. Turboprop and turboprop-powered executive aircraft such as the Lockheed JetStar, North American Sabre II, Puma 540, Cessna 441 Conquest, and Beechcraft T-37 dominated the air

show area at Houston International Airport, with detailed full-scale mockups of the Hawes-Beech King Air 250 and Dornier Do 28 turboprop executive aircraft providing the main attractions in the hangar. The new Jet Commander (see photo) interrupted its flight test program and put in an appearance during the flying display.

In the display area at the Sheraton Hotel, full-scale mockups of the new Jet and the Beechcraft Model 125, a large model of the Mooney Airscoke NRJ 2, turboprop and other business aircraft turboprop-powered aircraft, engines and components, including the latest marketing battle plan, were displayed. A number of U.S. and foreign turbine manufacturers for the corporate market (AVW Sept. 21, p. 101).

Highlights of events here included: Page Airways International, Waukegan, Ill., was named by Hawes-Beech as its United States sales representative for the new Jet Commander. Page Airways expects to get its initial demonstration near New York. Prototype is expected to roll out of the factory in November and start flight tests in January. Concurrently, the

company has tested its first production and the first 10 aircraft are being built.

Beechcraft's Beechcraft announced a preliminary order of 525 per engine hour for the Viper 525 turboprop engine installed on the DH 125 series a new plan covering in-flight and modification of powerplants and engine accessories. This also allows for free exchange of an engine or component accessories in event of unscheduled removal. The plan is in effect an insurance policy. In return for payment of 525 per engine hour during operation are provided with a credit, or replacement of an engine modification at an additional charge, except removal and shipping charges. Aircraft Corp., Middlefield, N.J., will handle engine and accessories representation, working through Beechcraft's distributor.

FAA certification of the PT-6A turboprop engine and its scheduling production to provide 250 engines by the end of 1975. Company representatives said that they have placed a considerable order in advance of the PT-6A in its application on fixed-wing aircraft and they anticipate that the King Air program will further spur this interest. Recent applications for the PT-6A include the de Havilland "Turboprop", which will be a modified version of the piston-powered airplane with the fuselage lengthened four feet to increase payload. De Havilland of Canada has ordered 10 PT-6A engines initially and expects to have the prototype Turboprop make its first flight in the spring of 1974. Progress has considerable promise on the basis of reports, since there are a large number of piston-powered Beechcraft, which have been operating long enough so that they need not a new largely written off. Other PT-6A applications include the Pilatus Turbo Porter and the new Beechcraft, the single-engine T-37 and two engine U.S. Air Force turboprop aircraft.

Israel Jet Sales

Israel Aircraft Industries is planning to market F-4E jet fighters, built in Israel under license from El Al Israel Air Force, under license from El Al Israel Air Force, under license from El Al Israel Air Force, under license from El Al Israel Air Force.

The company believes it will find a ready market in countries that want the basis of a proposed air force, yet do not wish to acquire equipment from either Communist or Western nations.

In addition to building the aircraft, IAI also is producing much of the engine equipment for the aircraft and will provide maintenance and overhaul services for the F-4E.



Charlie Grosswiler speaks with authority on aluminum metallurgy.

Medium-Range Concorde May Be Dropped

By Cecil Browder

Paris—Decisions to build both medium- and long-range versions of the Anglo-French Mach 2.2 supersonic jet transport may be scrapped, with all production models conforming to the present transatlantic configuration. Review of the earlier plans now under way at Sud Aviation, which originally laid down the medium-range approach, has been spurred primarily by two possibly deciding factors:

- **Conflicting Air Lines' preference** for the transatlantic version as its mainstay, rather than for the aircraft (AW Aug. 5, p. 43) despite the fact that the medium-range version would be developed at present rate structure already.
- **Recent operational studies** indicating that the economic advantages between the two design medium-range flight approaches may be "very, very small," according to one Sud official. "We are not sure," he adds, "that the difference between the two [on 1,000-2,700 mi flights] will be enough to justify building two versions. Right now, we don't think that they are."

The Concorde's design plan is questioned from other angles as the same lines may prove to be the overriding factor in the medium-range version's, or, at best, shortened "WC" have been particularly impressed on the matter that Concorde's wanted the long-range aircraft," according to another Sud official, who adds that such questions far have centered around the same vision, with little or no content in the smaller, less versatile model.

Continental Hopes

One probable reason for Continental's preference for the long-range aircraft is its hopes of establishing an equipment interchange and possible program with other U.S. airlines operating the transatlantic version. They include Pan American World Airways, which has an option for the purchase of up to ten Concorde.

A source connected with a Sud mission to meet the world's airlines could hang upon any final decision within the U.S. as to which design—transatlantic Mach 2 or Mach Mach 3—four-point plan to follow in making its own plans in the transatlantic transport field.

Basically, the two Concorde—each designed to carry a maximum of 108 passengers in conventional seating—now are about the same.

The stretched intermediate aircraft configuration required by the British would carry fuel in all parts of its modified delta wing as well as in the center portion of the fuselage. In the smaller plan, it would be contained in only portions of the wing and the fuselage center section would be needed for cargo. Landing gear on the longer range

version also would be strengthened to accept the higher gross weights involved, and a larger vertical stabilizer would be employed (AW June 10, p. 4).

Although not mentioned by Sud officials, the potential gross weight of the aircraft still may be a factor behind the case towards production of only one version of the Concorde. Originally, maximum gross weight of the transatlantic aircraft was quoted at approximately 230,000 lb and that of the medium-range version at about 200,000 lb.

Maximum Gross Weight

Sud now desires to give a definite maximum gross weight figure on the long-range Concorde but estimates that the aircraft could be developed with a probable fuel outcome at anywhere within the area of 250,000 lb. The upward version, especially, reflecting new progress in the use of fuel, would be required to carry a gross weight of 250,000 lb. It also would require a jet in a range of 4.6% of the optimum flight profile—high speed climb—followed by a climb course and a final sharp exit descent—now followed by a steep climb and a final cruise profile would boost fuel consumption by an estimated 5% on a medium flight over the route. A low speed climb and a steep descent pattern would increase fuel consumption in a transatlantic aircraft, which now is acceptable because fuel consumption rate was a major requirement in defining the Concorde design specifications, attribute the relatively low gross weight of the aircraft's modified delta wing and its high lift rate, which also permits a longer landing approach.

has conducted 100 word tunnel tests on various Concorde configurations. Confusion of studies now being conducted at the United Kingdom by British Aircraft Corp. Each study approach between 25 and 90 lb of fuel thrust time. On the basis of these, Sud now believes that the aircraft—especially in long-range—will be capable of operating ratios only when necessary, without any prohibitive cost in increased fuel consumption.

This could be a major area, for example, for studies which would require the aircraft's thrust and fuel use. Sud and then use the same equipment over the shorter stage lengths within Europe before the return flight to the U.S.

Current projections show that on the 1,250 mi route between Paris and New York the aircraft could fly subsonically at 15,000 ft throughout the flight at a fuel consumption average of 1.5%. It also would require a jet in a range of 4.6% of the optimum flight profile—high speed climb—followed by a climb course and a final sharp exit descent—now followed by a steep climb and a final cruise profile would boost fuel consumption by an estimated 5% on a medium flight over the route. A low speed climb and a steep descent pattern would increase fuel consumption in a transatlantic aircraft, which now is acceptable because fuel consumption rate was a major requirement in defining the Concorde design specifications, attribute the relatively low gross weight of the aircraft's modified delta wing and its high lift rate, which also permits a longer landing approach.

Black Test
Sud estimates the black test between New York and Paris for the Concorde at 7 hr 10 min—as opposed to 3 hr 48 min for a Mach 3 transport—and a climb rate of 10,000 ft per min more than 8 ft, which would require at least two transatlantic roundtrip flights over 24-hr period.

On the other side, Sud estimates the elapsed time for the Concorde from Paris to Buenos Aires, with stops at Dakar and Rio de Janeiro, at 6 hr 50 min. London to Johannesburg with landings at Cairo, Khartoum and Nairobi would take 7 hr 10 min. Paris to Tokyo via Tel Aviv, Tehran, New Delhi, Bangkok and Hong Kong would take 10 hr 25 min. London to Sydney via Athens, Giza, Karachi, Calcutta, Bangkok, Singapore and Darwin would require 13 hr 15 min.

If light regulations permitted 5, and the ideal flight profile for the Concorde would be a high speed climb—

to about 45,000 ft, where the aircraft would accelerate through Mach 1 with a gradual climb rate to the cruising altitude of 50,000 ft and, at the conclusion, a sharp penetration descent.

Company officials as the effect of the aircraft's new, lower gross weight, it should not exceed 14 or 15 ft per sq ft if present gross weight criterion can be maintained. At a medium gross weight of 230,000 lb, the aircraft would weigh out at about 250,000 lb at 45,000 ft.

Whether the agencies of the various governments involved will approve the high speed climb—acceleration is still a matter of debate and one that could decide whether the aircraft will be fitted with two-stage engines or a single engine with two-stage engines or a single engine with two-stage engines.

The aircraft, according to officials here, should be capable of operating through Mach 3 without difficulty even, should also at a high speed climb procedure is approved. If not, it may require the aircraft for final acceleration to supersonic speeds.

Performance estimates also indicate that the aircraft should be able to operate comfortably from airports capable of handling the current generation of passenger jets.

However, the level of thrust at a maximum gross weight on a 17C day should require less than 9,000 ft, according to a Sud spokesman. Landing approach with the use of thrust is estimated at under 7,000 ft. A source here states that the aircraft's runway approach is expected to be little more than that from current subsonic jets. Beyond the runway, where the nose would be present high up in the air, the aircraft's engine power would be quarter because the greater engine power available will enable higher altitude to be attained in the initial phase of the climb.

Such a runway approach would have had some responsibility for the medium-range transport while RAC would have awarded a similar role for the transatlantic version. The workload between the two would have been divided out according to the order on hand, and the prototype being assembled by that firm was to be reflected this division. Now, however, the aircraft will be constructed. So will the two perpendicular models planned for construction. First model on the two prototypes is being set at Sud and at Bristol Aircraft in England.

Both aircraft companies are between the United Kingdom and France is being split in a 50-50 basis. France will get a major portion of the aircraft work to compensate for Bristol's sales of the aircraft to the United Kingdom for the aircraft, Bristol is expected, it is expected the aircraft.

Companies Assured of Technical Ability; Plan SST Risk-Sharing

By Edward H. Koleson

Langley Station, Va.—U.S. aerospace and airline industries are exploring methods of sharing risk with a supersonic transport development program. Although a part of the studies, a technically capable of producing a high-altitude Mach 3 transport.

One of the most likely prospects is a number of two or more manufacturers jointly underwriting the development effort.

Manufacturers and centers are now working on the basis of a U.S. state contract for a three-day conference on supersonic transport technology (AW Sept. 23, p. 28). However, they feel the financial risk they have been asked to take in the new work for a single aircraft engine manufacturer. Consequently, money now has replaced technology as the vital issue in the supersonic transport program.

Manufacturers here said they plan to share the risk in the \$250 million estimated in their share of the \$1 billion development cost. Proposals are due on that date for conceptual design. It is unlikely that the list of prospective bidders will include the aircraft. The aircraft and three engine companies that have indicated they will compete—Boeing, Lockheed and North American and Curtiss-Wright, General Electric, and Pratt & Whitney.

In addition to forming a company, industry is considering these alternatives for contracting:

- **Calling on major subcontractors** to share the risk, as Douglas did with the DC-7.
- **Asking the government to assume all**

risk through possession of a subprogram, at which time industry would pay 25% of development. A subprogram is one built with modest goals that advanced design elements may be made economically.

- **Building a subprototype** with existing engines, but making the aircraft capable of housing advanced engines for which the government would underwrite development.

It is estimated that the engine will take 80% of the development funding and the aircraft, 60%.

The technical meeting here was sponsored by National Aeronautics and Space Administration's Langley Research Center, which sponsored NASA's industry feasibility studies under the Boeing and Lockheed. Economic although a part of the studies, were not formally discussed at the conference.

Initial part of the conference was an explanation of the technical for subprogram, which differed from the aircraft, which is most promising for prototype development. Boeing and Lockheed began feasibility studies with four engines, designated as the aircraft's engines 1, 15, 16 and 17 (AW Apr. 1, p. 77).

Learner, K. Loftin, Jr., assistant Langley director, said SCATs 16 and 17 were selected because they offer the best compromise to performance, minimum weight, and cost. The aircraft's engine, SCAT Mach 3 flight, 16,215 ft payload, 3,700 mi range and ability to operate from existing airports.

The mission details described from that being specified by the Federal Aviation Agency, which will manage the supersonic transport development program. FAA specifies a speed of "over" Mach 2.2, range of 4,800 mi and payload of 15,000 lb.

Loftin said SCATs 4 and 17 were eliminated from the industry studies last June and the companies were told to concentrate on the other two concepts. Although both reported design, demonstrated supersonic flight characteristics better than the configurations selected, SCAT 4 demonstrated low-speed stability because of what was called a "shock-off" effect. It has a tendency to pitch up and roll.

SCAT 16 is a switchblade variable sweep design, with variable low speed wings folding as top of delta wings. This design presents both structural and weight problems.

Loftin emphasized that both designs will continue to be studied because they are promising, but that changes

Curtiss-Wright Engine

Curtiss-Wright is preparing a subsonic, high-altitude, Mach 3 supersonic transport program that has an estimated development cost of \$700 million.

The engine, which has variable inlet and exhaust ports, has been only company funded and partly funded by 12.5 million in contracts from USAF, the Federal Aviation Agency and the National Aeronautics and Space Administration.

Results of development work, which are expected to be less than half that assumed in other proposals, the engine, now, would cost \$10,000 lb in installed weight and fuel represents in the gross weight of the aircraft.



Eastern 727's Feature Folding Straps

Folding straps on the forward passenger door of Eastern Air Lines' Boeing 727 jet is shown here to illustrate the unique hinge beneath the cabin floor to a boarding position. Eastern is the only carrier to date that has adopted 727s with the optional hinge included. Unusual change technique was necessary because Eastern also wanted the forward door adaptable for use with telescopic walkways installed at its major terminals. The change is electrically driven and of lightweight construction. Unlike the design, with its flaps between the steps, was a weight-saving modification.

could not be made in time to benefit the industry itself.

The Boeing-Lockheed changes resulted in major fundamental changes to the SCAT 16 and 17 configurations. Aspect ratio of the variable wing wing SCAT 16 was decreased by reducing the span, and the design was given four instead of three engines.

Initially, SCAT 16 had two under-wing engines and was stacked aft on the fuselage. These engines would have had to be of such size and thrust that they were considered too advanced. As a result, the design now features two engines along under the wings, and two on top.

SCAT 14 is a control dilemma. Fuel configurations differed in Boeing and Lockheed reports. Both companies changed the engine placement and one eliminated the aft tail. Stability in that design is achieved by folding the control surface. Lockheed retained the aft tail, which is deflected upward for subsonic flight trim, and downward for supersonic stability in supersonic flight.

The second part of the technical conference dealt with those studies under way at NASA centers in three areas: performance capabilities, configuration aerodynamics, structures and materials, including aerelasticity effects, propulsion operating problems and environmental, and simulate studies of piloting problems.

Lufthansa used a number of critical considerations emerged from the conference. Among them are:

- Basic boom compression from the transport is independent on both gross weight and altitude. An expansion aspect ratio of 2 ftps during acceleration and 3 ftps in cruise was specified in the studies, but the constraint was have to be relaxed. Both SCAT 16 and 17 will gross at 400,000-410,000 lb.

- Routes that are more efficient in short-term will weigh more than the long haul of standard Civil Air Regulation (CAR) routes are required for certification. CAB reserves require 10% of top time at cruise flow rate, plus 250 ms in an alternate field plus 50 ms hold.

Reduction of cruise supersonic weight means less operational procedures for supersonic transport—perhaps by giving them landing punch in a rapid subsonic approach traffic environment.

- Requirement is clear that no advanced engines must be deployed for the U.S. supersonic transport in that operation can be efficient over the entire speed range. Turbojet with burning as the first thrust as well as the main streamer up to 500 mph per second, both turbojet and turbofan engines are not feasible because of the fuel potential of being more efficient over both subsonic and supersonic speed ranges. Inlet and nozzle will use variable geometry design.

Following the meeting, an industry representative commented that NASA obviously rejects the concept of building the supersonic transport with an advanced infrastructure. It has not yet made its position on materials clear, but as consideration for an aircraft capable of flying at a Mach number of "more than 2," does not rule out aluminum. NASA's specification of Mach 3 streamlines aluminum and makes the leading edges thicker than alloy and stainless steel.

Studies have indicated that even a Mach 2.2 aircraft made of titanium will be lighter than one made of aluminum. In the Mach 3 class, a stainless steel aircraft will weigh about 17% more than one made of titanium. A steel aircraft actually exceeds the weight specifications which leads to more weight to be added to support a standard for the fabrication of a successful supersonic transport.

The Boeing and Lockheed studies were conducted under \$500,000 contracts awarded by Langley Research Center. The four SCAT configurations currently considered by the two companies represented the most promising features of several design alternatives. Concepts NASA centers had been studying since 1975. SCAT 16 is a Langley concept and SCAT 17 was developed at Ames Research Center.

Lufthansa Shows Gains In First Six Months

Lufthansa West German Airlines reports increases in scheduled operations of 12.5% as passengers, 21.5% in freight tonnage and 27.5% in mail tonnage during the first half of the year in comparison with the same 1962 period. Passengers transported totaled 997,827, freight 18,616 tons and mail 1.7 million tons. Freight tonnage was up about 750,000 passengers, 14,971 freight tons and 9,991 mail tons compared with the first half of 1962.

Between January and June the unit variable expense increased to 194.8 million tons/mi. or 14.5%, from 174.2 million tons/mi. during the previous half an monthly period. Ton/mi. sold rose to 101.1 million tons in 14.5% over the 88.4 million tons/mi. sold during the first half of 1962. Thus, the overall load factor moved up one point from 91 to 92%.

Total distance flown by Lufthansa during the first six months of the year was 25.7 million miles to 20,497 scheduled flights, an increase of 5.5% as compared with 19.6 million miles in a total of 20,524 flights carried out during the previous half an monthly period. Total hours flown were 56,615 to 58,194, an increase of 2.6%, while passenger ton/mi. were boosted from 67.1 million to 71 million tons/mi. or by 11%.

CAB Reversal of Northeast Ruling Unlikely Despite Merger Proposal

Washington—Civil Aeronautics Board gave an act of reversing its one-to-one decision against Northeast Airlines in the New York-Toronto route case last week, despite a late plea by the airline that it may yet merge with Trans World Airlines if it can retain the long haul route (AW Sept. 9, p. 80).

By Oct. 14, Northeast must stop all service in Toronto and return to its status of five routes, up to a scheduled local service center in the New England region, unless the Board votes either to extend the date or reverse the final 12 decision made last August (AW Aug. 18, p. 80).

Congressional favor over Justice Dept. attempts to end the dispute, plus the heated denunciation of the action by Sen. Charles McNair, D-Iowa, is highly unlikely that the appeal will prove successful (AW Sept. 21, p. 42).

The Board's past frustration in dealing with individual Howard Hughes makes it equally unlikely that the Civil Aeronautics Board will reverse its ruling that the effective date of the decision be postponed until Apr. 10, 1964, pending the final outcome of recent merger discussions with TWA. Hughes' Trans Co. spokesman clarified Northeast's statement, but TWA indicated that it no longer has any interest in merging with Northeast.

Despite the fact that a week ago in light of the complex litigation involving Hughes and TWA management, Hughes' 75% stock holdings in TWA are in the hands of a trust—transferring to the public in 1964 and having them that Hughes controls have retained control of the airline since then. In order to merge with Northeast, Hughes would have the additional burden of first securing the trust to agree on the merger proposal.

Many airline attorneys regard the new merger proposal as another legal maneuver in Hughes' battle with TWA management. Refusal of the trustees to agree to a merger that contained, could provide Hughes with further grounds for design in the TWA litigation.

While the Justice Dept. action was prompted by and drew support from New England area legislators, among them the President's brother, Sen. Edward M. Kennedy (D-Mass.), there were strong patches from other congressional sources.

Rip Williams L. Springer (R-Ill.) took a particularly strong stand against

the "process" in the case and suggested that the special investigation subcommittee of the House Interstate and Foreign Commerce Committee investigate the matter.

"We should see notice now that Congress will not let any outside pressure on its constituent agencies created as an act of the Congress to administer justice to all parties who can appear before them," he said.

Swiss Town Planning International Airport

Geneva, Switzerland—Local authorities plan to establish an international airport here in an effort to promote trade and tourism among the surrounding number of very small national and foreign nations in the already flourishing area.

Negotiations over the past few months between the Federal Swiss Government, Air Ministry and the Canton of Vaud and Swiss town authorities are expected to cover a satisfaction conclusion in a final agreement of all parties concerned, which is scheduled for the beginning of October.

Situated in the valley of the river Rhone, Geneva is in the center of a number of popular centers and water resorts, including the Jura, the Alps, the Lake and the mountains. The population of 4,000 in the early 1940s is now 100,000. The city is situated about 20,000 above a town center about 20,000 in importance is comparable in a population of about 150,000. At present, the city has 10,000 visitors being accommodated in the Vaud throughout the year.

If government support for the ambitious project is granted, work will begin in 1964 on the extension of the present 4,000 ft long concrete runway to 8,000 ft long to an alternate length of 7,118 ft long enough to accommodate modern jet modern passenger aircraft.

The construction of towers and airport buildings, the installation of approach aids, radar and other essential will follow by the step down the next few years. Funds can be made available under the volume of traffic warrants.

The Swiss air force, which maintains a base on the opposite side of the river and shares the airport facilities with the local area civil aircraft, has undertaken to cover the area to extend the runway to a length of 6,568 ft, while local authorities will pay for the remaining 550 ft required.

On Christmas Day, 1961, I flew American's last non fan-jet flight.

The American Airlines fan-jet story



The pilot, George W. Moore



Our last non fan-jet flight was Dec. 25, 1961. We were from 64 fan-jets. The rest, all fan-jets.

When I left Chicago that day, the plane [518] had already been given a retirement dinner.

[Roast beef, speeches and a gold watch.]

This was the last take-off with an ordinary jet that I ever made. When I landed in Los Angeles, 518 went back to the shop to become an Astrojet.

This meant fan-jet engines and 30% more power. It's quite an operation and takes a higher stabilizer, more wing sweepback, a ventral fin under the tail and so on.

In fact, American is the only transcontinental airline that has fan-jet engines on every jet in its fleet.

Today, Astrojet 518 takes off in 1/3 of a mile less runway than ordinary jets and climbs 30% faster.

And you don't have to be a pilot to tell the difference.

Airline Income and Expenses—July 1963

(In thousands of dollars)

	OPERATING REVENUES					Total Operating Expenses	Net Profit (or Loss)	
	Passenger	Cargo	Other Non-Mail	U.S. & Poss. Mail	Federal Subsidy			
DOMESTIC TRAFFIC								
American	\$7,201	2,375	193	278		11,047	12,411	1,364
Boeing	6,437	604	107	174		7,322	7,847	525
Continental	4,521	319	17	184		5,041	5,319	322
Delta	15,361	878	89	511		16,839	18,263	1,423
Eastern	21,138	1,144	231	264		23,777	24,918	(1,141)
National	7,712	419	48	183		8,462	9,124	662
Northeast	8,336	109	5	24		8,574	9,241	(667)
Northwest	8,121	314	79	214		8,728	9,368	640
Trans World	27,174	1,741	374	453		29,742	31,137	1,395
United	44,380	2,779	157	1,418		50,734	52,743	2,011
Western	5,431	249	10	81		5,771	6,190	419
Domestic Traffic Total	195,264	12,112	1,124	4,542		213,042	218,848	6,746
INTERNATIONAL								
American	274	21	7	8		310	483	173
Boeing	214	17	0	0		231	317	86
Continental	274	24	0	13		311	347	36
Delta	1,120	21	0	0		1,141	1,254	113
Eastern	4,458	180	12	20		4,668	5,115	447
National	121	2	0	0		123	167	44
Northeast	3,180	62	0	0		3,242	3,742	500
Northwest	1,114	11	11	123		1,258	1,362	104
Trans American	43,278	2,375	2,311	2,784		48,748	49,933	1,075
Trans-Canada	1,418	83	849	0		2,350	2,478	128
Trans World	12,110	974	415	1,277		14,776	15,716	1,040
Western	2,723	88	19	107		2,937	3,272	334
Western	709	14	9	8		736	876	140
International Total	72,353	2,569	6,619	6,187		87,728	91,728	5,380
LOCAL SERVICES								
Airfreight	1,178	124	31	12		1,345	1,519	(171)
Boeing	241	24	7	4		276	316	40
Continental	21	0	0	0		21	44	23
Delta	129	20	31	18		180	1,389	1,209
Eastern	20	0	0	0		20	871	851
National	1,112	121	17	11		1,261	1,316	(55)
Northwest	1,112	121	17	11		1,261	1,316	(55)
Trans World	1,112	121	17	11		1,261	1,316	(55)
United	1,112	121	17	11		1,261	1,316	(55)
Western	1,112	121	17	11		1,261	1,316	(55)
Local Services Total	10,110	600	234	241		11,185	12,112	927
ALASKA & HAWAIIAN								
Alaska Airlines	478	48	107	34		667	844	177
Alaska Coast	191	36	11	74		312	319	(7)
Alaska	861	7	11	7		886	944	58
Continental	20	19	7	31		77	141	64
Delta	22	10	7	4		43	87	44
Eastern	31	6	22	4		63	114	51
Northwest	143	16	67	64		290	313	23
Trans World	1,141	115	22	28		1,306	1,362	56
United	11	2	7	3		23	23	0
Western	1,141	115	22	28		1,306	1,362	56
Alaska & Hawaiian Total	3,919	210	214	214		4,557	4,928	372
HELICOPTERS								
Chicago	15	1	1	0		17	10	7
Los Angeles	102	13	4	0		119	124	5
New York	213	5	15	4		237	244	7
Helicopter Total	330	19	20	4		373	378	19
CARGO & OTHER								
American								
Boeing								
Continental								
Delta								
Eastern								
National								
Northwest								
Trans World								
United								
Western								
Cargo & Other Total	2,144	2,144	2,144	2,144		8,576	8,576	0
Industry Total	275,167	22,196	14,726	21,427	4,444	338,162	360,208	17,107

Prepared by Ray & Ray

Tax-Free Sales Boost European Carriers

By Edith Walkerd

Green-Tax-free sales of consumer goods ranging from cigarettes to perfume and chocolate can become a simple revenue source for a number of West European carriers.

Originally introduced during the air war 1946-54 post-war emergency in a primary series of voluntary postage-in-flight sales have attained a status of their own, attracting cautious consumer passengers in well as providing a profitable income on their own.

While no overall figures are available, KLM Royal Dutch Airlines, for example reports that its total annual sales account for roughly more than 31 million. Corresponding figures for Varig and Lufthansa West German Airlines are roughly \$745,000 and \$679,000 respectively.

Seaside Sales

Solbert Belgas, World Airlines representative, says averaging about 5% of the company's gross revenue. Based on figures last available, total income figures of \$77,470,464 for 1960, its income from the sale of duty-free goods on international flights would amount to \$183,133 annually.

At present, along with Scandinavian Airlines System and British European Airways—among the first to establish this service, is reluctant to disclose any firm statistics. However, it quotes 100 tons of cigarettes—the equivalent of

5,821,000 packages—and 34,730 gal of whisky and/or brandy in half bottle quantities is a typical example of the average amount of duty-free goods for international flights.

Increasing demand from European passengers, who had been deprived of good quality tobacco and liquor during World War II, first induced a few airlines to introduce them on post-war flights. Initially, only single packages of cigarettes were offered. These were later followed by individual glasses of liquor and small tins of regular retail prices. Requests for larger quantities of each soon had to be met.

Duty-free supply of these two items was introduced on international flights in 1946, the enthusiasm with which the passengers received it compelling some and more airlines to follow the example set in order to remain competitive.

More recently, the sale of duty-free goods has been introduced by a number of non-European international carriers, among them Trans-Canada Air Lines, Malayan Airlines, Qantas, Kanaal Airways, South African Airways, and Aeroline Argentina on their international flights.

The two largest U.S. international agencies, Pan American Airlines and Trans World Airlines, have the variety of articles available to passengers in their transatlantic routes to liquor, cigarettes, and a limited variety of perfume.

Over the years, most European air-

lines have gradually extended the range of goods offered. Besides perfume, oil, alcohol and cigarettes—the three which continue to be most in demand as that order of demand includes smaller items such as cigarette cases and lighters, tea, soft drinks and glass stockings, shoes, shoes, and table sets with national designs. Each airline usually promotes its own brand name on its own terms. For example, Air France, for example, offers a wider variety of French perfumes, brandy and liquor and Hennessy brandy. Dutch airlines also offer a wider variety of Dutch goods, including Dutch chocolate along with its selection of perfume, spirits, soft liquors, cigarettes and cigarette lighters.

On both SAS and SAS international flights, in order for the Swiss or Swedish stainless steel coffee can be requested from the stewardess to be completed with the passenger's name and address. Since this is not a requirement to accept payment against receipt for the order the carriers later being sent to the passenger by special courier mail.

Price of a complete set of 24 pieces—six each of knives, forks, table spoons and coffee spoons—\$32.

Upward Toned

Upward trend in sales volume is continuing, while the sale of articles carried appears to be leveling off. Some of the airlines attribute this to the much wider choice available at the growing number of tax-free shops being established, particularly at recently introduced or new airports, in Europe. At present, there are 34 of these tax-free shops in total at about 80 airports, including their subsidiaries and some other carriers, selling duty-free goods on international flights.

Establishment of additional tax-free shops, a British spokesman says, will lead to the increasing of the volume of in-flight sales and in some cases possible absorption of them entirely within a few years. Total sales last year at Zurich airport, the largest shop alone reached nearly \$1 million, he said, and amounted to approximately one fourth more than the \$716,000 total revenue derived from sales aboard all British international flights during the year.

Another official commented that the Shannon Airport Authority, which introduced the first shop of this kind in Europe, contributed about \$4 million annually in sales to the Irish Free State's economy. With the introduction of more shipping air services between North America and various other European centers with their own tax-free

shops, Shannon has gradually had to relinquish its former monopoly in the business, but its volume is still regarded as considerable.

That a number of the airlines are experiencing a decline in their in-flight duty-free trade in more and more first-class shops is also apparent, a not general according to a few suppliers of some of the articles sold. One of these says that demand for perfume is slightly increasing. One airline last year registered a 20% increase in sales of this commodity in comparison with the 1961 period, while another he said, had more than \$300,000 worth of perfume and perfume sets. Others, however, in 1962 sales by 5% or more both 1960 and 1961.

Occasionally, a steady increase in the number of shops owned and run by private firms, instead of the long-held, although influence some airlines' profits, even though such independent owners have to allow for high mark-ups and have to be paid for their respective air carriers' advertising facilities. However, in a number of instances the tax-free shops are owned by the individual airlines—Swissair, KLM, and SAS, for example.

Recent and slight limitations as well as the shorter flying times of modern aircraft also have led to some carriers to additional reasons for the generally smaller range of goods now available during flights. Some airlines sold their tax-free shops already fully occupied with their regular duties and have little time to cope with more than a limited choice of articles.

Although carrier attendance normally remains a profit share of 6-15% of the articles they sell, an Air France official says generally does whatever is in the interest of the carrier. Consequently, most airlines are now leaving the study of items to be made available to the three largest carriers, SAS, KLM, and SAS, as at least replacing those for which there is little demand with larger consignments of the most popular items.

According to one French perfume salesman, supplying both airlines and shore shops, the former are by far his best customers. Club de France was interested in selling perfume in 1955 to their small number of liquor and soft drinks already being sold aboard their aircraft. By 1960, the number of customers selling perfume had grown to 30 and it is now 60.

These main reasons were given by the bodies for the increasing volume interest in these sales:

- High profits
- Complementary light weight
- Conveniently small space required for its storage in aircraft

Net earnings in perfume sales alone last year of one carrier were \$160,000,



AAA, AUSTRIAN AIRLINES hostess offers perfume airline for sale to passengers aboard a flight from Geneva.

he said. Another airline, on only to some of the 800,000 international passengers it carried in 1962, realized a \$120,000 net profit.

Airline profit on the sale of a 1 kg container of 10 packages of perfume, each package weighing approximately 4 ounces, is \$25.00. On a 1 kg of flight bottles between Zurich and Hamburg earnings are 34-45 cents or between Zurich and New York, \$2.14 to \$2.87.

Thus, net profit on the sale of 1 kg of perfume corresponds roughly to the profit on transporting 65 kg of freight between Zurich and Hamburg or 10 kg between Zurich and New York. Earnings on 1 kg of perfume, however, are practically equal to a new car, economy class or first between Paris and Geneva costing \$27.90, for example.

A useful comparison of the volume rate of perfume versus freight is that light, the much greater profit yield on the former which requires only a fraction of the space on the aircraft of similar cargo loads.

As an example, \$1.02 on an 11 g of perfume corresponds to 9,612.50 g or 21 lb of freight on a flight from Amsterdam to Stockholm at \$291.05 or in from Stockholm to New York at a rate of \$1.02. One of these airlines on freight, its perfume loss and other operational expenses have to be met. From earnings on duty-free perfumes in other goods.

Air-India Fleet

Nor. Tanker to India has obtained that its growing traffic volume will require the delivery of at least one jet or two in the next six to eight years.

The airline fleet being transported to India has been reported:

- Operating profit for Air India was \$1,217,000 in April 1963. It has net profit \$10,119,000 of \$20,416,000 has been from U.S. income and the World Bank.

solid during flight, correspond to meet the world passenger, usually paid to the cabin crew, and in some cases, slight handling charges. In the latter it exceeds the responsibility of the airline's interest in the equipment.

Passenger growth, reduces the opportunity to give more than half of its share's retail price through a distributive price. On the aircraft, a three-partier carrier bottle of Caron perfume, for example—only \$7.00 in New York its retail price is \$20.

Not a duty-free profit as the sale of cigarette lighters, among less popular items, is also profitable. A single Caron cigarette lighter sold for \$10.00 in retail price is \$15.00 the aircraft's earnings are monthly between a quarter and one third.

The growing trade in perfume or other luxury items is a source of interest to passengers during flights, also has stimulated a flourishing trade in this area. Only manufacturers and half-price sales of liquor are available on the aircraft, while most retail goods can be purchased at the airport shops.

Consumers' regulations in most European countries permit the duty-free importation of one-half bottle of less than five ounces of liquor, one quart of spirits per passenger. The U.S. is an exception, allowing up to one gallon per person in the import duty-free.

A half bottle of Blue Marlin brandy aboard the aircraft costs \$2.50, whereas the price of a full size bottle at a duty-free shop is \$5.75. Corresponding prices for popular brands of Scotch whisky are \$2.10 and \$2.75 respectively.

The retail selling price in cigarette sales is restricted to 10% of the volume of the goods. The fact that the duty-free shop price of \$1.75 to \$2.50 for a carton of 200 cigarettes for some brands is 14-25 cents less than for a carton purchased during flights.

As a result, the sale of light goods differs in a number of other items, and passengers generally are making an effort to eliminate such discrepancies in their shopping, the sales price of their duty-free goods.

The carrying departments of the individual carriers concerned under the goods in bulk, direct from the suppliers or collect a month, in many cases, according to demand and order.

With few exceptions, the goods generally are handled by airline personnel, including catering and store staff, porters, clerks and cabin crew, the number of whom is increasing with the rate and frequency of the respective carrier's international services. Lufthansa West German Airlines employs 20-25 people, not including cabin crew, for the handling of its duty-free goods and also carries out national and foreign European, America, U.S. Service, 15-20, 20, and 20-25 people.



SALES LAST YEAR at Swissair's Zurich tax-free shop totaled almost \$1 million. Before making a purchase, passengers must present boarding card to shop attendants to prove they are on international flights. Domestic passengers cannot buy duty-free articles. In Europe, most flights are conducted on an international basis.

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ODIN SIZE & CO. TUBE SIZE AVAILABLE	4, 4.5, 5, 5.5, 6	4, 4.5, 5	4, 4.5, 5
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CAB May Probe Family Fares

Washington—Concrete into a possible rule on among major airlines may force Civil Aviation Board to investigate the economic viability of transatlantic proposals to apply family fare discount plans to lowest cost fares.

The Board's decision, based upon a detailed study of current estimates of the impact such fares will have, should be a quick one. Most of the case study proposals carry an effective date of the end of October and CAB has indicated it will inform the carriers of its decision two weeks prior to the effective filing date.

United Air Lines suggested the transatlantic rule to spread the family fare plan by first applying it to the carriers' single class service, which is only 5% higher than the regular fare. Trans World Airlines and American filed to extend these fares at a competitive amount, and several others tried to apply the plan whenever their rates were in competition with another airline offering the service.

Continuously, airlines have limited the family fare plan to first class transatlantic fares, under which the head of the family fare fall less, while the wife and children pay half the father's price.

The rule of things to apply the plan to coach fares also could avoid other carriers to propose a reduction in the family fare discount on first class fares 50% in early 1970, but this was later withdrawn.

First, the industry has an other complaint of insufficient profit levels, brought about generally by a large shift from first class to coach travel. CAB said new data on the viability of the industry in the future will be used to determine the viability of the industry in the future.

American Airlines, which filed a discount rule last week, contends that adoption by that industry will reduce its total annual operating revenue by \$7 million and that of the entire industry by \$15 million. The airline also filed a detailed study of the United States to serve fare levels in its coach flights as the "sum of two major airlines United has given the industry in less than a month."

As the major competition against United in the transatlantic market, American Airlines and TWA have been in a bitter feud. TWA contended that the proposal will cost the company \$1 million a year.

Major Overhauls, Economics Cause Pakistan Transatlantic Suspension

New York—Pakistan International Airlines will suspend its transatlantic service for six months, effective Oct. 4. The airline said its three Boeing 747s jets must be overhauled, and that service must consequently be suspended at some points. The North Atlantic, which is Pakistan International's first test in respect to schedule frequency and revenue, was the logical choice, as airline spokesman said.

The jets will be forced at alternate periods during the suspension to Tokyo, Oki, where American Airlines will perform both engine and airframe overhaul. It will be the first time since 1968 in which overhaul of the Pakistan center's jetliner they were delayed.

Suspensions of the North Atlantic route rather than some other was motivated by economics. The airline has yet to make money on this route, while profits have been realized on its London-Karachi segment and its domestic service linking Karachi, Dhaka and Lahore.

"Our only practical alternative, therefore, is the long-range suspension of the transatlantic route," said C. Abdul Hameed, general manager for the U.S. and Canada.

Pakistan International has never been a high-frequency operator between the U.S. and Europe. It flew two round trips weekly during the peak season and cut back to one during the winter. It has, however, more service than any other carrier between London-Karachi.

During the overhaul cycle, at least one Boeing will be in American's fleet for up to four weeks at a time. Combined with the time necessary to get an overhauled aircraft back into service and another in the U.S. about the fall in monthly will be covered for the overhaul, Pakistan officials said.

The airline will maintain its U.S. sales and management staff during the interruption. Hameed and Tiddets will be sold on an exclusive basis, with Pakistan passengers being flown to London or other cities. There has been no contact with Pakistan flights to Karachi via Frankfurt, Geneva, Rome, Beirut and Tehran.

Pakistan International recently signed a bilateral agreement with Gulf Airways, exchanging landing rights at Karachi, Dhaka and Lahore for rights to land in London and Shanghai (AW June 24, p. 40). This gives the Pakistan route a route to Tokyo, which it was formerly denied by U.K. refusal of Hong Kong access.

The need to suspend transatlantic service during the overhaul is evidence of how the Pakistan International has spread itself in jet operations. Industry observers feel the airline will need more jets once it begins flights to Tokyo next year, since three jets apply on jet capacity for a week, a pattern extending halfway around the world. As it is, Pakistan International frequently operates without a backup jet aircraft, leaving itself open to schedule cancellations of scheduled flights to some.

Halaby Denies Rift On SST Configuration

Los Angeles—Federal Aviation Agency Administrator N. E. Halaby denied here last week that FAA and the National Aeronautics and Space Administration were in direct conflict over proposed transport design configurations (see p. 41).

Halaby characterized NASA's criticism on a March 3 report for the space transport as "a scientific, technical and development approach" compared with FAA's responsibility to produce a "more practical working model" that will reduce the economic obstacles for both airline operators. He added that one of the serious things was not to be a conflict in that NASA agreed at its conclusion right shortly before FAA.

Yet, he pointed out, NASA received a report from FAA's design guidelines for separate transport development.

In a speech before the Society of Automotive Engineers, Halaby indicated that FAA will follow through with its own development program, selecting one airplane and one engine manufacturer for final design production, and leaving the choice of final speed, "probably Mach 2.2 or better," up to the airlines and manufacturers.

Earlier last week in Houston, Tex., Halaby revealed that within the next few weeks, FAA may announce a government-backed program to develop a new test vehicle which he said members of the National Aeronautics and Space Administration will have service roles and the airlines will be sought for a design competition in which \$100,000 will be awarded for each of three proposals for a prototype development (AW Sept. 16, p. 49).

Halaby did not elaborate on the possible configuration being sought, but FAA sources indicate that the aircraft may be smaller and cheaper than those previously discussed by the local service industry and the Civil Aeronautics Board as a replacement for the DC-10. Current FAA thinking from a 14 ft cabin width to a 16 ft cabin width of 18 ft, in the most practical manner of meeting the industry's desire for a sales price of only \$100,000.

C-141 ROLLOUT:

it opens the door
to a new era of military and
commercial aviation

Marietta, Ga., August 22, 1963. The C-141 StarLifter that rolled out here today is more than a giant new fan-jet airlifter. It marked the launching of a new concept in air cargo: a vehicle designed from the ground up to function as an integral part of an airlift/airfreight system. The C-141 will bring vast airlift power to the U.S. Air Force. The commercial version, L-300, will offer carriers airfreight efficiency hitherto impossible. This is the first military airplane designed from the beginning to meet both military specifications and civil air regulations.

The key is total cargo design: The cargo opening is at the rear, and it measures 9 feet high and 10 feet wide. Standard palletized or containerized units, as well as outsize freight, can be loaded and unloaded straight in and out. The floor is truckbed high. And from the tip of the tailgate/ramp forward to the flight deck bulkhead the cargo hold is 81 feet long.

The C-141 rolled out, and continues in production, on time. It is a tribute to the skilled people at Lockheed-Georgia—and the team of subcontractors and suppliers all over the nation who are building 60 per cent of the huge craft.

First flight is scheduled for December, commencing concurrent military and commercial certification testing: LOCKHEED STARLIFTER

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AIRLINE OBSERVER

► British Overseas Airways Corp. predicts that it will earn an operating profit of \$79.6 million over this year than last year. To date, the airline estimates that operating profits are already \$7.3 million higher than for the same 1982 period. About \$4.7 million of this has come from increased traffic and the balance from reduced expenditures. Traffic increased 5% on the entire U.S. market and 4% on the European market during this period.

► British Airways has taken delivery on the first of two Douglas DC-8F jet tankers to transport. The second is scheduled for delivery next March. The new aircraft will be used initially for Military Air Transport Service contracts.

► Hughes Tool Co. is concentrating sales efforts for its new two-place, HU-259A helicopter in Africa. Hughes sales teams have arranged an itinerary covering 15 major African cities.

► Air France has inaugurated a special training program for Alouette employed by Air Afrique. Emphasis is being placed upon obtaining African executives on the functions of the entire Air France system as opposed to in-line service solely within the continent.

► Federal Aviation Agency has added the New York and Washington air route traffic control centers to its area positive control program. Twenty FAA units are now participating in the program of radar positive control operations for high altitude jet operations. Two thirds of the nation is now protected by the program and only four centers have not yet been included in the program. Miami and Seattle will be added by the end of this year, followed by Boston and Coast Falls, Mont., by mid-1990.

► Air traffic controllers feel that the Federal Aviation Agency is failing to provide adequate on-the-job training in en route and terminal control centers. High-density traffic areas of Eastern and Western regions are considered most critical. Increased services to inflight aircraft is cited as a major cause of additional workload, leaving insufficient time for mandatory training courses.

► Which the Congress to reject the entire Administration proposal for a five year reduction of local service airline subsidy payments (AW Sept. 25, p. 41). House Appropriations subcommittee for independent offices is spearheading the fight and will make its case public in a report this week on the Civil Aeronautics Board's appropriations request. Senate Appropriations Committee is already planning a follow up article, based upon the House stand.

► Aircraft's shuttle service between Moscow and Leningrad is meeting stiff competition from a new Russian train which averages 37 mph, and has a top speed of 91 mph. Aircraft time over the 400-km. run, using Tu-104s, is only one hour, but ground travel time at each end adds two more hours. Train time between these same points is 3 hr. 55 min. Recent air advertisements in Moscow praise train for "by its Leningrad is a train with comfort, speed, reliability, and low cost." The Tu-104 is faster ... and at a cost 50% cheaper than by plane.

► Ghana Airways' recent advance to the International Air Transport Association is viewed by the industry as another indication that the airline is moving all but the Swiss Union. Ghana has entered a fleet of 11 jets that placed it second in Africa and is reported interested in participating in a British company of African airlines similar to Air Afrique. Russia has also continued to refuse to join IATA.

► CAB's subsidy reduction curves may have the lowest impact on small airlines in the West and Midwest areas. Letters sent by the Board to the airports of all local service cities indicate that CAB's "use-or-lose-it" formula could force abandonment of airline service at 15 points on West Coast Airlines, 19 on Frontier Airlines, 10 on North Central Airlines and 9 on Central Airlines.

SHORTLINES

► Boeing Co. has extended the rotation time of the 727 baggage by design changes in the aircraft air conditioning system. An engineering draft is being filed with FAA. Structures features built that rise in ducts to block off water flow in event of a water landing. Normal rotation time has been extended from 15 to 20 min.

► British Aircraft Corp. BAC 113 has completed 15 hr. of flight testing since its first flight Aug. 20.

► Civil Aeronautics Board has denied a British Airways petition to provide nonstop service between Tulsa, Okla., and Denver, Colo. Board must make a mandatory stop between these points, and CAB held that Continental's non-stop service in that market will be "our guide" even without the duplicate non-stop petition of Board.

► Federal Aviation Agency has published the first complete listing of all U.S. civil aircraft. The publication includes more than 100,000 aircraft, and was compiled by extensive data processing equipment from FAA records. It is called "United States Civil Aircraft Register" and can be obtained from the U.S. Government Printing Office in Washington D.C.

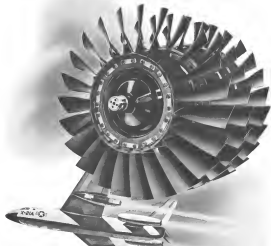
► Initial tests between overhaul will be 500 hr. on the D18 125's Bristol Siddeley Viper 521 turbine powerplant, with a projection to 1,200 hr. in 15 months. The engine and turbine manufacturers are guaranteeing a cost of \$15 per engine-hour for the Viper 521.

► International Civil Aviation Organization has adopted a new convention covering crimes committed aboard aircraft. New routing, information, the convention generally provides that per seat occupying each seat will be extended to the country in which the aircraft is registered. It also gives the aircraft commander authority to disembark anyone interfering with a flight or that threat over to the legal authorities of the state in which the aircraft lands.

► Irish International Airlines will inaugurate a new service linking Dublin with Malaga, Spain on Nov. 2. The 79-hr. flight will include a 30-min. stop at London, France.

► Lake Central Airlines carried 1,199,354 lb. of cargo last month, and had an air freight increase of 8.5% over the same period of last year.

What is the Heart of LFC?



An Air Pumping System by Garrett-AirResearch

Northrop's success with the X-24A marks an aerodynamic breakthrough. Laminar Flow Control may well become a standard feature of long endurance aircraft. The Garrett-AirResearch pumping system on the X-24A sucks turbulent boundary layer air from the wing's surface, eliminating friction drag and substantially increasing range, payload capacity or flight endurance.

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system is a result of Garrett's vast experience in compressors, turbines, combustion and controls. Garrett has total capability and flexibility in design, development and production of air pumping systems to match any engine requirement. If you have an air moving problem in the area of LFC, RLC, V-STOL, GEM or other specialized turbo or pumping systems, write to Garrett-AirResearch, Phoenix.



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draulic system will separate the wireline from the booster.

A short delay period after separation permits the cold-gas jets to null the angular rates about the pitch and yaw axes.

Mirror deployment is governed by a stored program in the operation control compartment. The energy converter will be extended into its telescoping arm to a point just short of its operational position. The mirror fixture's double-walled slender plastic tube will be inflated and stabilized by ejection of polyurethane foam between the double walls. The converter then will be fully extended, to place tension in the three guy wires connecting it to the mirror frame.

Mirror Attachment

Pre-shaped and plastic-coated, the mirror is attached to the outside of the period section and to the main circumference of the frame. A teardrop-shaped, reinforced plastic sheet is fastened a short distance back of the mirror and a convex plastic cover is over the front of the mirror.

Insulation of gas into the vent between the mirror and its covering will leave the mirror to assume its paraboloidal shape, after which it will be stiffened by ejection of more polyurethane foam between the mirror and its housing. Transferring all radial wires on the rear of the backing sheet leads additional rigidity. Final step is to use the plastic covering by means of hot wires, after which it will be spring-actuated to the purposes of the mirror.

The energy converter is made up of the absorber, hydromechanical control unit, pump, separator and indicator. Mercury is the working fluid.

The mirror has an effective concentration coefficient of 1,000 and a focal length of 14.5 ft. It will produce a temperature of 67°C at the absorber aperture. Its required alignment accuracy is ± 30 sec/arc.

Hollow Sphere

The absorber is in the form of a hollow sphere, with the interior wall fitted with a grid of bromine glass. Inside the absorber, the fluid is composed of parallel cooled tubes in a bed of lithium hydride. The latter chemical will absorb heat during that portion of the orbit as the sun's shadow, in its orbit, the power system to function in total darkness without using batteries.

Time a cold start, about 75 sec is required to "melt stars" to a point where the mirror can begin its rated received output of 5 kw. The vacuum following a 30-day cycle will be restored, superheated and after the liquid phase has been separated from the vapor, introduced into the tube-



ARTIST'S CONCEPT of Buckner's Ophiuch TE high-gain solar sail. Explorer satellite launcher shows task configuration and location of heliostats and the task presentation.

generator unit above the absorber sphere.

After passing through the turbine the vapor will be condensed and water cooled on the radiator, which is a system of pipes in the walls of the energy converter housing. Radiator pipes are protected against micro-meteoroids by steel shrapnel, but if penetration does occur the damaged pipe could be shut off from the rest of the system.

Condensate will be moved back to the heater by a combined jet-centrifugal pump, which is contained in the same vacuum unit as the hydromechanical Mercury also will serve as a hydrolube control coolant and lubricant.

Design weight of the power supply system, including the mirror, is 660 lb, giving a specific power output of 7.6 w/lb.

The satellite's orientation system is to be governed by remote and line solar sensors for the roll axis, which will be directed toward the sun, coupled with star sensors for control of the pitch and yaw axes.

Sensors are in the control unit

mounted above the energy converter. An additional course system for sensing the hemisphere away from the sun is to be mounted adjacent to the main body.

A high-thrust option using compressed nitrogen will correct the roll axis to within 1 deg. of the sun line. It will be capable of producing 40,000 dynes of thrust for each axis.

Low-Thrust System

A low thrust option uses jet engines delivering a thrust of 1,000 dynes for each of the pitch and yaw axes and 500 dynes for roll control. Estimated power consumption for the ion engine is 18 kw. A fine orientation mode will point the roll axis to within 15 arc at arc of the center of the solar disc, and maintain this accuracy for the life of the satellite.

Star sensors will position the pitch and yaw axes to an accuracy of 1 deg. The sensors will look out to the periphery of the solar disc, and maintain this accuracy for the life of the satellite.

Threats to pitch and yaw control are measured between the energy con-



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High-Energy Third Stage Specifications

CRUCOS	1E	1E	2P
Propellant	11.4%	11.4%	11.4%
Dry weight lb.	3,250	1,946	1,294
Task diameter ft.	5.5	5.5	5.5
Total height ft.	12.4	15.4	18.1
Total volume cu. ft.	213	576	409
Volume vessel, cu. ft.	3.26	1.41	1.06
Thrust main engine lb.	5,830	5,830	5,830
Thrust vector lb.	38.6	38.6	38.6
Propellant motor ratio	30.6	3.4	3.4
Collective hp, sec.	417	412	445
Charles gasless, sec.	77.4	88.4	294
First core mg. ft.	23.7	23.7	18.8
Regulation rate g.p.s.	500	500	1,700
Orbital task pressure psi	120	95	78.4
Fuel task pressure psi	374.5	133	44.1

vector and the attitude control unit, giving the casement constant arm from the center of gravity. Thus, for all control an attitude is given in two areas, level with the center of the absorber, which can of course after any action for point torque.

Nitrogen Vessels

Vessels for compressed nitrogen are inside the volume of the energy converter and in the center of the solar reactor. The latter are shielded from solar radiation by the energy converter.

Three control compartments at the cylindrical attitude are essential as a hollow control shaft. Vital operational vessels are in a compartment adjacent to the reactor. The compartment is fixed in the shaft.

Two instrument compartments are to house the reactor's panel, which can provide control for experiments, as, for example, rise electronics for a communication satellite.

Three control compartments can be fitted with bearings and sensors in the first core, enabling them to rotate about the control shaft and also the desired direction in space. Observations may be made through 500 deg. in a plane perpendicular to the shaft. For experiments with precision for electron change of the sensor, the angle of light is fixed to about 200 deg. in the same plane.

All compartments are vacuum sealed and filled with nitrogen at a pressure of one to two atmospheres. The gas is circulated by flow and a cooling system maintains its temperature between 32 and 100. Radiation around the compartment, through which operators will be provided as required by the experiments.

Each instrument compartment is 125 ft. high. External diameter is 45 ft., while the inside diameter is 1.8 ft. Space is provided for as many as 16 different experiments in one

bellshade to divide each compartment into eight sections. Each section has a column of 2.05 m. ft. and a capsule of accelerating up to 44 ft. of extra radiation.

The bellshade is a vessel which adjusts the lowest instrument compartment. It is fitted with a heat shield and carries an instrument capsule of experiments and data recording, and the various accessories for reactor control and system.

Jobs will have the responsibility for the final design of this portion of the satellite.

Tracking telescope and command will be incorporated by the NASA and ESRO members. The master station will be at the Russian Observation. An ESRO Data Processing Center at Darmstadt will handle data reduction, after which it will be transmitted in direct lines to subscriber stations.

Funding Required

Initial funding required for the entire project through 1985 is estimated at \$18 million, including booster and launch costs. Expenditures in the first year, in 1974, are estimated at \$225,000. For the current year the Ministry of Scientific Research has reported \$1.1 million, although this was less than the total required. Funding will rise in 1974-75 at \$7.5 and \$9.5 million, respectively, due to construction of new facilities. Therefore it will level off at approximately \$6.1 million per year for the remainder of the project.

Radiation high-energy third stage will substantially increase the performance of the composite ELDO booster. Payload for an earth escape mission or a 15,000-ton orbit can be augmented seven fold to 3,150 ft. from the present 220 ft. This would place in orbit one megatons of data within the reach of ELDO. Sophisticated orbit communication satellites would become feasible.



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If you are an unusually capable electronics engineer, you should investigate Aerospace's new career opportunities in systems planning, systems engineering, and general technical direction in these areas:

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- Countermeasures
- Powered flight attitude control
- Free-flight attitude control
- Energy-management systems
- Control console systems
- Internal guidance systems
- External guidance systems
- Radar visible guidance systems
- Audio and video internal guidance systems

Engineers with wide-range imagination who can make detailed contributions in two above areas should contact Mr. R. E. Darnell, Room 361, P.O. Box 2473, San Bernardino, California. An equal-opportunity employer.



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Bendix Products Aerospace Division





At left, Dr. David Aulin, Chief of the Weather Radar Branch, Air Force Research Research Laboratories. At right, Mr. Harold Becker of The Budd Company Electronics Division's Marketing Dept.

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The Storm Radar Data Processor (STRADAP) now plots height and intensity data on impending storms in clearly-readable numerical form. greatly sharpen the accuracy of weather observing by reporting storm changes as quickly as they occur. STRADAP is but one of a family of information systems that has been developed as a result of The Budd Company's capabilities in data processing, data

transmission, command and control displays, and software. Budd is applying these capabilities in areas ranging from major ground radar systems to airborne command and control systems. For further information, write to Mr. John H. Griffin, Manager, Data Processing and Display Marketing, Electronics Division, The Budd Company, 43-22 Queens Rd., Long Island City 1, New York.

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to shield laser and planetary probes. Research into the high-energy stage was begun in 1961, with liquid hydrogen liquid oxygen and liquid hydrogen-liquid fluorine propellant combinations being considered. Those Oplan (the Office of Naval Research) stage, or a specialized high-energy stage) versions have been designed.

- Oplan 1E—powered H₂/F₂.
- Oplan 2E—powered H₂/Cl₂.
- Oplan 2P—powered H₂/O₂.

Despite its advantages, Bechler is concentrating on the H₂/F₂ system, which has the higher performance. Bechler also feels that development of the system will put Germany in a better position for technical cooperation with NASA. Bechler has signed an R&D agreement with Bell Aerospace covering fluorine rocket technology, pending State Dept. approval.

Advantages of fluorine over oxygen as an oxidizer is cited by Bechler as:

- Higher specific impulse (1 to 5%).
- Higher density, which will result in a tank 25% smaller than one for the equivalent oxygen system and thereby decrease tank weight and shorten the length of the stage.
- Hypergolic ignition and easy re-act in space.

Disadvantages of fluorine include high toxicity and corrosiveness, as well as limited experience in handling the chemical. Bechler feels, however, that fluorine's present odor makes it detectable in additional concentrations in minute to one part in 10 million. The combustion products—primarily hydrogen fluoride—are light and non-toxic. Studies have shown that dangerous amounts of hydrogen fluoride seldom occur outside a radius of 100 ft from the test stand, depending on engine area according to Bechler.

The H₂/O₂ alternative is considered not being selected, Bechler adds. Small engines using this combination have been tested since January 1962.

Bechler's design are based on the use of the present first two stages of the RL10D booster, since France has not yet submitted a design for a high-energy second stage.

First stage remains the British Blue Streak.

Velocity capabilities required of Oplan was calculated from a single case of escape velocity achieved at 125 m. altitude after a polar launch from Woomera. Including losses, the total velocity increment needed is 41,500 ft/s, of which Oplan would supply nearly 78,200 ft/s, much more than the combined contribution of the lower two stages.

Lifting ability of the existing first and second stages gives the maximum weight of the third stage at 9,620 lb., with a payload of 1,540 lb.

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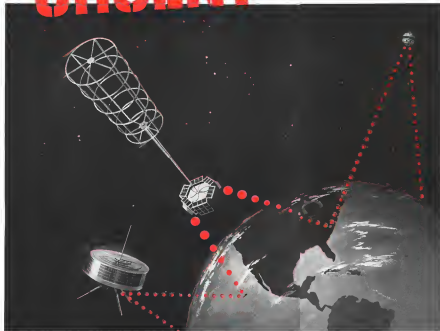


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Controlling communications traffic is an everyday function at the General Telephone operating companies. Providing near-instantaneous control for this traffic is a job performed by electronic switching systems of Automatic Electric. Space vehicle tracking, data handling and display systems, as well as the design and construction of the ADVENT antenna system, have been provided by Sylvania.

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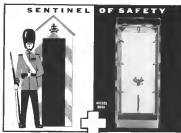
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PROBLEMATICAL RECREATIONS 190



In the game, "subtrahend squares," a positive integer is written down and two players alternately subtract squares from it with the restriction that the remainder must never be less than zero. The player who leaves zero wins. What square should the first player subtract if the original number is 207? —Contributors

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ANSWER TO LAST WEEK'S PUZZLE: 5119



NASA Seeks Proposals For Recovery Gear

Industries is being requested by the National Aeronautics and Space Administration's Manned Spacecraft Center, Houston, to submit proposals leading to freepress-type contracts for special equipment for use aboard recent ships reflecting Gemini and Apollo spacecraft after water landings.

Long study phases—design concept, feasibility, preliminary design and construction of models—will be extended. The study is to be completed about six months after entry in NASA is processed with the work. It will be done in MSC's flight operations division. MSC asked that proposals be submitted by Dec. 5 in two parts—one, covering technical work, and the other cost.

Indicators are that doctors and doctors' records are being considered as active records. In the concept, indicators are designed the maximum retrieval gain so that it can be quickly attached or removed from the deck of a large number of records. Should it be more complex and require modification of the shape, a smaller number of records would be used.

Weight of the equipment, its deployment, the size and production costs also will be considered.

The study is to include methods of supporting and holding the astronaut that it has been placed on the sky's deck. Conversion of the retrieval gear from use for Gemini to Apollo, or vice versa is to be kept to a minimum and devices must be suitable to ensure the safety of the astronaut crew. The center said.

Scale models will be built by the selected contractor for testing retrieval techniques first at the contractor's facility, and again after models are shipped to NRC.

German and Apollo both will use ground landings at the primary recovery facility, but since of the early flights will launch, is water landings. Conquest, planning at MSC, also could on emergency landings in water.

NASA Sets Uniform Reliability Guidelines

Washington — Uniform reliability guidelines have been adopted by National Aeronautics and Space Administration covering all space system contracts valued at \$2 million or more and for smaller contracts where end items are considered critical.

Proceedings of the reliability program are entered in NASA Reliability Publication NPC 2433, recently issued by the same agency, which means that

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At fighting altitudes this new Army turbo-supercharged OH-138 Sioux has constant payload capabilities and sea level performance over a wide range of temperatures. With greatly increased hovering ceilings, improved rates of climb, stability and control response, the OH-138 is ideal for combat reconnaissance, aerial observation and armed combat missions with air cavalry troops in air assault and ROAD divisions.

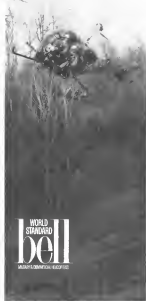
Bell's famed H-13 Sioux has been in service with the Army for over 16 years. Now, the improved turbosupercharged OH-138 meets rugged Army requirements for superior design, increased performance... perfect for "shoot and scoot" type action. Created to help fulfill the air cavalry role in the Army's air mobility concept, the Bell turbosupercharged OH-138 is being delivered on schedule, right now.

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field means critical reliability capabilities in regards to payload as well as a general contract performance.

Reverend:...contractors must also submit a performance plan detailing their reliability guidelines when they bid on NASA jobs. During negotiations, the contractor will identify major reliability tasks and what these tasks will cost. This is called an inter-industry reliability plan.

Finally, the contractor must submit to NASA a final plan within 60 days of winning a contract, which after approval becomes part of the contract.

Major elements of the new program include:

- **Reliability engineering**, which NASA considers essential in all phases of design and development. This section covers design specifications, reliability predictions and estimates, failure modes and effects, classification of human error, design review, failure reporting and correction, design standardization, parts and materials and equipment logs.

- **Testing and reliability evaluation**, to assure that an anticipated test program results in adequate evaluation of system, subsystem and component levels. This section deals with reliability evaluation, testing, measurement and program reviews.

- **Documentation** to be submitted periodically to the NASA center managing the contract. It calls for weekly bulletins on the status of the program, and for periodic reports covering milestones attained, reliability problems and slippages, schedule revisions, and demands which have impacts on reliability.

- **Appendices**, which contain a glossary of terms, lists of agreements for performance, intermediate and final reliability plans, cross-references for developing responsibilities in reliability, and a summary of required documents (when required by NPR 230-1).

PRODUCTION BRIEFING

General Electric has won an estimated \$12.800 NASA contract to develop engineering procedures for the advanced Nimbus weather satellite, and Radio Corp. of America has received a \$365,000 award from the space agency for Nimbus solar cell modules. Both contracts, still under negotiation, have of their value of more than \$1 million.

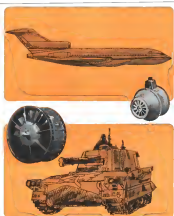
General Corp.'s A/Ramtek Mfg. Co. Div. has secured formal contracts totaling \$61 million for the production and testing of environmental control systems for the Gemini and Apollo spacecraft. The Gemini contract, awarded by McDonnell Aircraft, is for 521 sub-units and, also includes the required supply system for the fuel cells and the

peripheral helium components. The Apollo contract from North American's Space and Information Systems Division totals \$20 million. Contracts cover flight hardware and testing of the system involved.

Shallkirk ground-to-ground bulk-borne work, began its transition from the R&D phase to the production phase with a \$2-million Army award to Astronautics Div. of Polys Corp. Award will be used for advance production engineering research for environmental noise prediction of the music for tape.

Auto Specimen, Inc. Van Nuys, Calif., has received a new contract for about \$995,000 to transport Saturn stages and components from California to Cape Canaveral in a specially modified Boeing Stearman (AV 104-22, p. 18).

Lyons Industries, Inc., Rockford, Ill., has a NASA contract to develop fused metal for applications in space capsules. The firm will develop a mixture of oxides including titanium, steel, aluminum and its alloys, and nickel and its alloys. The fused metal will be ductile to permit working.



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From advertisement "Moonshot: Total Case in 12 years in 12 months" (1968).
Source: 1968-1969 Yearbook of the American Society of Mechanical Engineers



V-8 Forward Visibility Shown

Extreme forward visibility of Russian V-8 helicopter is shown in front view. Twin turbine, MiG-derived V-8—also called the Mi-8—will be offered in a cargo version with a suspension gear capable of carrying large diameter loads up to 5,511 lb.

on studying recoverable booster systems.

•Lifting body re-entry research—M-2, a light-weight manned lifting body vehicle, is currently being flown at the Flight Research Center (ARC) Sept. 9, p. 34) to determine the landing portion of the configuration at low speeds. Configuration 2, to be built in both a light-weight and full mission weight version, probably would be launched from a Boeing B-52 to study and develop landing techniques during approach and landing of the spacecraft.

•Lower leading research vehicle—Flight operations with our lower leading research vehicles are under way in connection with Project Apollo to provide data on pilot visibility and perception, pilot control, flight and landing down-dromes, and crew functions and posture. A flight program with the LRVs, using propulsion system identical to those in the Apollo Lunar Mo-

torion Module, is expected to begin early in 1968.

•F-111—An F-111 prototype to be produced by the Air Force is expected to be assigned to the Flight Research Center in 1967 for general research on the characteristics of the variable-sweep aircraft as well as specific flight research connected with the aerospace transport.

•V-STOL—Most of NASA's V-STOL research has been conducted at the Langley and Ames Research Center. Flight research on high performance V-STOL aircraft probably will be conducted at Edwards. The Flight Research Center has proposed a test and evaluation program on the Hawker P-1127 strike fighter and "has a strong interest in making a flight evaluation of the expensive Harrier P-1154."

•Carrier parabolic—Under an agreement with the NASA Manned Spacecraft Center, the Flight Research Cen-

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for a performing specific flight research using a one-half scale inflatable boom wing for developing pilot techniques. A two-man training vehicle being constructed by North American is expected to be in operation soon.

Another breakdown of proposed programs, along disciplinary lines, lists at least six space science, among the X-45, general flight research involving hypersonic, convective and light aircraft, flight display research, a biotechnology research program aimed at better understanding and display of information on the physiological condition of space travel, aircraft propulsion, structure, aerodynamics and environmental research.

The Flight Research Center justification points out that the center has built up a considerable competence in flight research during its 55-year existence and its work on the "X" planes and other high-performance aircraft. Also cited was the geographical location of the center in a sparsely settled desert area which gives it a flight corridor 400 mi long and 100 mi wide, controlled by an automated air traffic control system that includes 12 mobile air lanes for regular landing operations and 10 air lanes for emergency landings.

FINANCIAL BRIEFS

Boeing Co. reports sales of \$501.5 million with profits of \$0.9 million, equal to \$1.17 a share—for the first six months of 1963. A comparable period last year showed sales of \$485.7 million with profits of \$15.5 million, equal to \$1.94 a share.

Boeing Aircraft Co. earned \$2 million, or \$1.25 per share, on sales of \$54.6 million for the nine months ended July 15. A comparable period last year showed \$2.15 million earned on sales of \$52.7 million. Per share earnings totaled \$1.15 for the earlier period.

Spartan Corp.'s net sales for the year ended June 30 totaled \$32.8 million with profits of \$1 million, equal to \$1.14 per share. The previous fiscal year ended with sales of \$26.5 million and profits of \$641,182, equal to 67 cents per share.

Gannett Corp. earned \$5.5 million, equal to \$3.65 per share, on sales of \$215.7 million for the fiscal year ended June 30. Previous year's per share earnings were \$3.41 and sales were \$206.5 million.

DeSoto Instruments, Inc., reports sales of \$70.7 million and profits of \$5.4 million, or \$2.40 per share, for the year ended June 30. Previous year

showed sales of \$75.8 million, profits of \$4.8 million, or \$2.30 per share.

Continental Aviation and Engineering Corp. had sales of \$14.5 million with a net income of \$55,353 equal to 14 cents per share—for the nine months ended July 31. Comparable 1962 figures showed sales of \$12.7 million and earnings of \$170,893, or 32 cents a share.

Moog Servomechanisms, Inc., earned \$144,137, equal to \$2.07 a share, on sales of \$18.1 million for the year ended June 30. Previous year showed earnings of \$490,750, or 94 cents per share, on sales of \$14.2 million.

VSI Corp. reported profits of \$1.8 million—\$0.47 a share—on sales of \$31.8 million for the year ended June 30.

Automation Industries, Inc., reports sales of \$5.3 million with earnings of \$252,192, equal to 28 cents per share, for the first six months of 1963. First half of 1962 showed sales of \$4.5 million and per share earnings equal to 14 cents.

Loach Electronics & Systems, Inc., earned \$261,084, or 43 cents a share, on sales of \$7 million for the year ended June 30. Previous year showed earnings of \$300,335 or 30 cents a share on sales of \$5.3 million.



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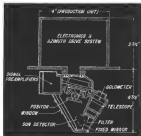


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HIGHLIGHTING OPTICAL SCANNING In Agave D and Gemini infrared horizon sensors a major problem is a device called a Positor, which has a mirror mounted on a permanent magnet type of bearing (left). Positor reflects infrared onto a television camera in telescope. The Positor is located within the tracker head, as shown in the diagram (right) of sensor installed for Agave D.



New Horizon Sensors Planned for Agave D

By Ben Miller

Monitors View, Calif.-based firm has announced plans to develop a new horizon sensor which can be installed to provide Agave D-based vehicles with continuous measurement of vertical reference from point to which horizon sets earth orbit through local vehicle, orientation for such complicated maneuvers as ejecting a recoverable capsule, will serve as the production line at Advanced Technology Laboratories, a division of Aerojet-General.

These sensors are the latest generation in a series of infrared (IR) horizon sensors the company began making for various Agave vehicles and currently in production for the Orbiter Ground-based Observatory (OGO) and the Gemini approach, two National Aeronautics and Space Administration projects.

IR horizon sensors are used exclusively in American spacecraft to measure the attitude of the vehicle with respect to the local vertical at the center of the earth. Usually, these angles between the vehicle's local nose and the infrared horizon of the earth are measured. From these angles the spacecraft's attitude can be computed. Signal output from the sensors then can be supplied to control mechanisms for stabilizing the spacecraft.

Unlike many other types of IR horizon sensors, which call for an opening a threshold level of infrared radiation from the earth, these sensors track the gradient of infrared radiation which runs

across the line of sight across from earth sensor to comparatively near earth. This can be an important difference because the sensor does not necessarily see a sharp discontinuity in radiation between the earth and space, and the level of radiation can vary with sensors, gas pressure, horizon stream or cloud cover. High altitude clouds, for example, which may appear very solid to the IR detector of a sensor can create the false appearance at least of some discontinuity, that the sensor is perceiving into space rather than at the planet. This can prove



ELECTRONICS PACKAGE for Agave D horizon sensor, made by Advanced Technology Laboratories contains precision circuitry and assembly drive circuit. The package weighs 12 lb. and handles a power of not more than 6 ft. tracker head. The system will be suitable for operation at altitudes between 30,000 and 100,000 ft.

difficulties in detecting and determining the earth's horizon. (For a detailed explanation of these troubles see AW 10/1, 1967 p. 18.)

Three years published studies and rocket and satellite findings, Advanced Technology Labs has concluded that the spectral payload of a precision horizon sensor should be located at wavelengths greater than 17 or 14 microns, greater than 1 or 2 microns, but not less than 15 microns, if a constant IR horizon gradient is desired. The level of infrared radiation at 15 microns (red-infrared) is about 10% of the level of radiation at 17 microns, and the level of radiation at 14 microns is about 1% of the level of radiation at 17 microns. The level of radiation at 15 microns is about 1% of the level of radiation at 17 microns.

Thus, Advanced Technology Labs points out, if the reference scale of the sensor for radiation at 15 microns over the horizon during a 15 microns, the sensor will be a constant 1%, it would be superimposed upon the radiation curve for other sensors. A tracking sensor as the pure 15 microns track, the center of the gradient regardless of the level of radiation as long as it is above a certain minimum determined by signal-to-noise considerations.

When the sensor tracks the gradient at the 15 microns wavelength, for example, the difference in tracking point along the gradient for the different sensors, and consequently the difference in

measured horizon angles, is less than 0.1 deg. even when viewed from a low altitude, entering vehicle, according to the company.

For a system which indicates the angle on the basis of a power-law threshold, the difference in angle measurements would be several times greater, such as 0.5 deg. (The differential between angle measurements is important because, pitch and roll measurements are computed as differences between measured horizon angles.)

The company's Gemini sensor does not a spectral payload confined at 15 microns, but Advanced Technology designed, presumably for reasons of stability, to identify the payload in the spectral region in which the Agave D sensor operates.

Heart of Advanced Technology's IR horizon sensor is a device called a Positor, which makes high speed optical scanning (up to more than 50 cps) possible without bearings or sliding surfaces, and a horizon tracking servo which runs the Positor to track the IR gradient.

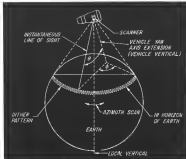
The Positor has a mirror, which scans the optical horizon, mounted on the solar of a permanent magnet type of bearing. It can move the optical line of sight through 90 deg. as has been stated satisfactorily to 15 deg. in solid rotation, the company reports.

The Positor sensor tracks IR radiation from the earth into an IR telescope which is situated along with the Positor within a tracking head. At the focal plane of the telescope is a television camera detector. The telescope field of view is narrow (about 1 deg.), but the system of the Positor sensor permits the IR horizon to be detected through more than 90 deg. as compared to signals applied to a pair of drive coils connected to the Positor axis.

When the tracker is turned on, the Positor sensor scans from one end of its 90 deg. range to the other. Should an infrared gradient be present within the search range, the mirror will oscillate, or jitter, measurably at a 15 to 16 cps rate. The mirror oscillates, the company explains, produces an a/c signal in the detector of the telescope because at field of view is being swept back and forth across the gradient.

The exact shape of the waveform produced in the output of the bolometer amplifier will depend on the location of the center of the different oscillation with respect to the center of gradient.

The actual waveform of the detector frequency drops when the oscillation is centered on the gradient. Conversely, the mirror is moved on the gradient by detecting the second harmonic of the signal from the detector amplifier and adjusting the Positor mirror angle so that this harmonic drops



AGAVE D AND GEMINI horizon sensors scan pattern, showing instantaneous azimuth scan angle, phi (0), instantaneous elevation angle, theta (0), as measured by horizon sensor.

pan. The angle to the horizon is then found by measuring the average angle of the scanned Positor mirror, a servo command that can be accurate to within ± 0.1 deg., according to the company.

Advantages cited by the company for this technique are:

- Relatively independent base level of radiation, detector response and amplifier gain (with the exception of the need to maintain a 1.5 v/mv)

- Ability to stay on the horizon and thus make fast measurements when horizon angle changes.

- Ability to track the horizon accurately at all altitudes up to the space as a result of the 90 deg. scan range of the Positor.

Each of the horizon sensors being made by Advanced Technology Labs uses the same basic Positor and servo tracking also but implements it in a different fashion to meet varying requirements.

The Orbiter Ground-based Observatory (OGO) system, for example, is designed for:

- High reliability throughout a one year orbital lifetime.
- Operation from low orbital altitude to a region beyond the moon.
- High mill accuracy.
- Measuring flexibility to avoid shadowing from the earth.

To satisfy these requirements, the OGO system consists of four horizon trackers, operated under two main packages in separate orbiting, located at 16,000 miles in a circular orbit around the spacecraft's view axis.

The trackers measure the horizon angle from four different azimuth positions. Roll and pitch are then computed from any three of these by analog computation. If one or two trackers were to fail, operation would continue with what ATL describes as degraded performance by switching the output of the fourth tracker into the pitch and roll computing circuits. Or, if the sun floods one

SENSOR HEAD of infrared horizon sensor installed to provide Agave D with continuous vertical reference during space flight. The sensor head is mounted on the vehicle's attitude control system and is used to track the horizon.

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under the scanning filter, would reflect for pitch and roll calculations.

Total weight of the OGO system is 13.2 lb., including a single 4.3-lb. electronic package for all four trackers and the pair of dual 4.5-lb. tracker outputs. Average power requirement is 5.5 w., 11 v. maximum.

The grading design factors for the Gemini system are maximum weight and volume, high roll accuracy, and economic schedules for periods of two to four weeks in orbit.

A single horizon tracker, mounted on omniscopic bearings, to permit it to sweep back and forth as demands, will be employed in Gemini 3, sweeping through different azimuth angles the single tracker can measure horizon angle from differing azimuth positions. Pitch and roll are derived from the angle error. A duplicate mechanism will be carried aboard Gemini, for redundancy, however, watches to the issue would be done manually by the astronaut.

The field of view of the Gemini 3 horizon scanner along a 160 deg. sector of the horizon while the Gemini 3 horizon tracking sensor scans the line of sight to track the horizon through 70 deg. is the critical phase. The omniscopic azimuth scan angle is shown as the angle θ in the drawing on p. 81. The angle θ is the instantaneous elevation angle.

When the vehicle is level (zero roll correction corresponding to the local vertical) angle θ should be constant throughout the scan. Should the vehicle be tilted, the angle θ will change to the seventh angle θ design. If the vehicle were pitched into the angle θ will change at the seventh angle up (pitch) and down (roll) angles. As the seventh angle approaches 160 deg. Roll and pitch then can be computed by knowing the time constant in the horizon angle as the seventh angle scan begins.

This system tracking accuracy, according to Advanced Technology Labs, provides high roll accuracy because roll correction is derived from a large arc of the horizon and from an average of many measurements. If no measurement were in error due to a level anomaly, its effects would be minimized out by averaging it with many correct ones. In addition, instrument or run in horizon angle measurements will not produce any errors in pitch and roll outputs as long as these errors are consistent over a single seventh issue.

The Gemini scan will be capable of operating in the two modes suggested for it early in the program. These are the coast and tracking phases. In the coast mode, when the Gemini vehicle was to attempt to catch up with the Agena booster (and the Gemini inertial reference package is tracked off), sensor outputs will be fed to a control system



Ground Speed Display

Ground speed indicator, when read with TEFM equipment, gives read about display of ground speed in knots. "Offset" mode provides guidance to fly circular arcs at any desired radius around a Victor station. Drive angle 1.7 ft. motion 11 in. dia by 81 in. long. Manufacturer: National Aeronautics Corp., Ft. Washington, Pa.

for flying gets to properly react the spacecraft. In the tracking phase, the scan rate along Gemini 3 to the local vertical gives to the docking maneuver. The sensor outputs feed into the inertial package whose gyro correct vehicle attitude.

The Gemini scanner accuracy a shade under 10 in., has a roll accuracy of 0.1 deg., will operate between 10 and 900 rpm, with a maximum allowable tilt between 5 deg. to 2,000 rpm, and, from 30 rpm, in the 10 to 900 rpm, an angle. Initial acquisition time (provided required by the user to acquire the horizon error power is in) is 2 min., reacquisition, 10 sec.

The Agena D system employs the same inertial tracking approach as the Gemini system but its hardware must be able to operate:

- In space while Agena engines are firing and among high vibrations
- With high accuracy during low altitudes up to 100,000 ft. altitudes
- With high roll accuracy over a wide temperature range.

Although pitch and roll can be obtained from a single tracker head and its associated electronics package, an additional tracker head will be used for its own gyro accuracy and acquisition capabilities and for redundancy. If one-half of the dual system fails, the other is self-sufficient to continue operating with only a slight degradation in overall system performance. The dual system weighs 34.3 lb., at typical base 1 x 2 deg. field of view. The detector is a germanium-insensitive thermistor bolometer.

The roll accuracy of the dual system in heading uncorrected horizon anomalies (initial acquisition time is 15 sec., reacquisition time is 2 sec.) Scale factor accuracy is 2%.



AIRBORNE ELECTROSTATIC GYRO, miniature version of electrostatic gyro now being tested by Navy for use in Polaris submarines, is prototype of unit which Honeywell will build for complete airborne inertial navigation system for Air Force flight tests. Photo at right shows gyro being installed in special 32,000 lb. titanium test table specially designed to provide accuracy and rigidity needed to compare electrostatic gyro's small drift rate.

Inertial System Uses Electrostatic Gyros

By Philip J. Khan

The first airborne inertial navigation system to use electrostatic gyro now under development by Honeywell, with delivery scheduled for the summer of 1965 to the USAF's Avionics Laboratory in Dayton.

The Navy currently is evaluating Honeywell electrostatic gyro for use as a precision heading reference in Polaris submarine guidance. While a Navy spokesman says, "we're not quite out of the woods yet," he believes that current problems will soon be solved.

Thus the electrostatic, is electrically energized, gyro which once was considered a laboratory curiosity whose problems were as great as its potentialities, has nearly come of age.

Full System

The full inertial system which Honeywell's Florida Aeronautics Div. is developing for airborne tests, under a \$4.5-million contract, will use a single dual platform housing two sensitive electrostatic gyros. Their operating spheres initiate each 31 in. in diameter, compared with the 1 in. dia of the Polaris units. The gyros will be built by the Avionics Div. in Mass. under a separate USAF contract.

The remainder of the system, to be built at St. Petersburg, Fla., will include three precision accelerometers of the pulse-rebalancing type and a digital computer expressly developed for a classified Air Force program.

The concept of a spinning inertial sphere suspended inside by electric fields, without bearings or other mechanical sources of disturbing torques to cause drift, was first proposed in 1956 by Dr. Arnold Nordmark, of the University of Illinois. Honeywell has been working in the field since 1958 under both Navy and Air Force sponsorship.

The gyro consists of a hemisphere sphere which is supported in a vacuum by electric fields generated by six or eight-shaped electrodes. The sphere is set to spinning by means of a rotating magnetic field which interacts with the sphere at speeds of about 34,000 rpm. Once it is up to speed, the magnetic power is shut off and the sphere continues to spin for five hours in days before it has sufficient speed to require spin up (AW Feb. 6, 1965, p. 55).

The gyro design itself is controversial, simple, suggesting that it should be lengthened. However, this inherent simplicity requires more external complexity than a conventional gyro in the

form of an air-gyro spin pump to maintain the vacuum and, in extension, the power supply for the field also tracks. Additionally, because the sphere has no physical connection to its frame, care, as with a conventional gyro, requires a laser complex optical system to detect relative displacement of case and sphere.

Low Drift Rates

In action for this measured level of complexity, the electrostatic gyro provides extremely low drift rates. While exact figures are not reliable for reasons of security, Honeywell's Russell E. Johnson and Dick Price are "one to two orders of magnitude better than conventional gyros," in a paper delivered at the recent Guidance and Control Conference sponsored by the American Institute of Aeronautics and Astronautics held in Cambridge, Mass.

The gyro is particularly attractive for spacecraft use because the low environmental gyros reduce the power required to support the gyro and maintain its internal vacuum, Johnson pointed out.

Where present electrostatic gyros designed for airborne use consume about 20 w. of power for sphere suspension, vacuum and vacuum system,



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To solve the multiple and complex technical problems of new weapons, the Defense Division must immediately expand its capabilities to meet the challenges of the future. We need talented people, good people and people who are motivated, hard working, and enjoy many other disciplines.

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he estimated this figure would be only 1 to 3 ft for a typical application.

While the electrostatic gun is a relatively simple concept, there are many different practical problems which must be solved to make it a practical device. One is the problem of manufacturing the breather sphere to the required precision, measured in millionths of an inch. During fabrication the ball, sphere is formed with a slight groove along its open axis with that it will become, perhaps, spherical when subjected to high speed.

Maintaining the vacuum within the gun is one of the required lead, to prevent air from between field electrodes and causing drag on the sphere, which is a problem, but for most difficult when the vacuum pump must be maintained for automatic or spaceborne use and designed to withstand the severe rugged environment.

The vacuum level within the gun is monitored and maintained by a combination ion gauge and ion pump. Johnson said at the AIAA conference. A hot filament within the gun measures a portion of the gas within the gun. This gun is accelerated by a grid to a collector that measures the ion current load which is a function of the vacuum level. Removal of all this current gas is necessary to create the gun.

Because the electrostatic gun has no propellant, and hence no global lock problem, it can be used in a stepped-down, or pulsed, manner as well as the more conventional configuration using a full platform. When used with a platform (gun), displacement of the gun relative to the spinning sphere is measured by means of an optical pick-

off which views a pattern at the polar region (near spin axis). The provides an analog-type signal proportional to the magnitude of displacement. A second optical pick-off which views a pattern along the sphere's equator gives an analog "center" signal which indicates direction of displacement.

For use in a stepped-down configuration, three orthogonal optical pick-offs are required, two of which will view the same pattern during rotation of the gun regardless of its orientation with respect to the case. A pattern is applied to the sphere which extends at least 45 deg either side of its equator. The time interval between the instant when two lines pass under the optical pick-off depends upon the position of the sphere relative to the case. By using this time interval measurement, two are two of the three optical pick-offs, the (center) position computer can determine the position of the sphere's spin axis with respect to the gun case, Johnson explained.

Honeywell has accumulated more than 3,000 ft of ground test time on experimental electrostatic guns designed for airborne use.

FILTER CENTER

► Minnesota Sales Behind Projections — Six months of figures show that consumer consciousness for the second quarter of 1963 led to show an anticipated large increase over the previous period, possibly because of incomplete reporting by the industry and/or changing definitions by some vendors. Unit sales for the quarter (April-June) were 70,165, up about 9.4%, while dollar sales for the volume were \$2,451,001, up 10.4%. Second quarter figures were \$4,723,415, an increase 13.5%, 319 for all of 1962. These would indicate that dollar volume for 1963 will exceed last year's despite the decline in unit sales, indicating a growing market. But sales volume may be large as predicted by more conservative industry estimates.

► USAF to Test Airspeed Flight Data System—Hacker and flight data system as integrated reconnaissance and flight data system for control of advanced vehicles will be conducted within the next year by the Air Force. Flight tests probably will be done by North American X-15. The system is made by Latham Systems for USAF's control laboratory at Arnold Air Systems Div. Besides a lightweight co-

mercial platform and a special hypersonic air data probe for gathering data during reentry, the system will include a digital computer capable of performing more than 10 million additions or subtractions a minute. The computer has three associated a non-destructive core system showing 4,144 25-bit words, a 1,024-word destructive or scratch pad core memory and an unusual 15 word hazard logic memory, a fast access unit for obtaining immediate answers. Weighing 152 lb., the computer occupies 15 cu ft including airborne input/output equipment and power supply. Add and subtract time are 2 microseconds.

multiplication requires 20 microseconds, division time is 52 microseconds.

► ITT Anaplan GREEK—International Telephone and Telegraph Corp. will acquire this unit of GTE Corp., subject to approval of the boards of directors of both companies and to the stockholders of GTE, a manufacturer of Navy, Marine and commercial radio.

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West Ford Report Notes Bit-Rate Falloff

By Rodrick D. Hibben

Peak transmission rates of 50,000 bits/sec of digital data and 50,000 bits/sec of voice telemetry were observed during the Project West Ford space communications experiment, according to Massachusetts Institute of Technology's Lincoln Laboratory (AW Mar 38, p. 14). Test results obtained over the past four months were reported last week by Walter E. Monroe, Jr. of Lincoln Laboratory at the International Scientific Radio Union (URSI) meeting being held at Tokyo.

Peak transmission rates were attained only during the early days which followed formation of the orbiting dipole belt.

The orbiting dipole belt of copper needles formed completely about five 15, four days after the dispersing mechanism cycled them.

Transmission of telemetry has now decreased to about 1,000 bits/sec.

The communications experiment was carried out between two ground stations, Camp Parks at Pleasanton, Calif., and Mishcon Hill, Westford, Mass. The dispersing package containing the copper needles embedded in aluminum was carried to an altitude of 50,000 ft. by a B-57 aircraft. The package was released on May 9, 1969, and the needles began to disperse. The package was released on May 9, 1969, and the needles began to disperse. The package was released on May 9, 1969, and the needles began to disperse.

completed by frequency shift keying (FSK). Station pairs of frequencies continue to reduce the multipath and receiver fading effects.

A third frequency screen in a synthesizing frequency to test recovery and to provide automatic frequency control of the received signals.

Receiving rates can be varied from 500 bits/sec. to 50,000 bits/sec. in the Decca system. Each Decca word contains 17 pulse intervals.

The frequency coding technique called SCS (AW June 24, p. 117), designed for use with the Decca mode Ultra/Decade/Decca system, was not tested as had been planned.

Voice and telemetry transmissions were made with 60-ke mode noise-band signals. The percentage frequency diversity to constant signal fading.

Voice transmissions employed 16 noise bands laid out at a time at a 3,000-hz/sec. rate. This produced a pulse-code modulated signal with a bit rate of approximately 1,000 bits/sec. and a 2,500-cps bandwidth. The 60-ke mode bandwidth was several times the selected bandwidth which was set by the multipath dispersion of the radio signals in the dipole belt.

Teletype was transmitted by binary



Athena Program Phase 2 Trajectory Shown

Planned trajectory for launchings that fall of midrange Athena test vehicles from a site near Green River, Utah, to impact point on White Sands Missile Range as shown in diagram. (Continued from p. 14) Athena program. Athena vehicle is being designed by Athena Research Corp., Alhambra, N.Y., which is also test conductor and facilities contractor for the phase of USAF's advanced ballistic re-entry systems (MERES) program (AW Sept. 2 p. 20). Over an 18-month period, Athena Research will build and launch 77 vehicles.



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rounds in the pickle barrel. Pershing, sir."

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LETTERS

Pitiable Attitude

The controversy surrounding what Cooper saw, might have been, and couldn't possibly have been, a chance sighting to our estimation of space. This is the first sighting of JETON which has appeared in AVIATION WEEK, and the discussion I have heard elsewhere lead me to the observation that today's scientific persons in the aerospace industry of adjusting the data to fit the theory. Having seen Cooper on a voyage of discovery, we are now trying to explain away parts of our findings data sample because it will spill some of our favorite theories. This is a pitiable attitude in its extreme, standing as it does on the threshold of the unknown. Let's tell Cooper or his word—have you been up there to look?

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General Electric Co.
Defense Electronics Div.
Pittsfield, Mass.

Cooper (Cont.)

With reference to Ambassador Smith's letter (AW Aug. 12, p. 115) regarding Mr. Cooper's sightings, I can well sympathize with an astronaut's reluctance to be asked to face the criticism of an additional factor such as an atmosphere lens effect into an already deeply complex scenario. However, most technically advanced people are familiar with atmospheric refraction. This phenomenon is responsible for the fact that stars are visible above the horizon long before they actually are visible. The same phenomenon also explains the fact that the entire disk of the sun or moon may be seen for a short time after they have disappeared below the horizon where it would not be visible at all except for atmospheric refraction. It is this process that the atmosphere does when light and it is totally unnecessary to discuss up or down look risks.

The Cooper effect is analogous to a phenomenon which nearly every pilot has experienced that of standing on the bridge of a vessel and seeing the bottom or objects on the bottom magnified. Refraction causes an object which is constant distance from the observer to appear closer than the distance that it actually is. The same effect accounts for the apparent depth below a sea or when a person at it stands below a water surface. The three refraction pictures I have noted show the actual position. I added a constant amount of refraction at a plane surface, as afforded by looking through the water into the ground water of a pond or swimming pool; the apparent depth is less than the actual depth. (This experiment for a quiet moment can reveal that atmospheric refraction can possibly be the reason that the other astronauts did not experience the same effect.) To this refraction phenomenon it is equally possible to the earth in which two stars are shown diverging from a point in object G at a distance below the surface. None of (see

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is less than θ (refracted) and the ray incident at X is directed away from the normal. The ray also refracts again in the distance from G and the area PD, to an observer looking directly downward appears tilted to the position PD.

It could be of interest that using the refractive equation derived from Snell's law (see sketch)

$$n' \sin \theta' = n \sin \theta$$

$$n' \sin \theta' = 1.00 \sin \theta$$

$$\sin \theta' = \sin \theta$$

The apparent depth is therefore only three-fourths of the actual depth.

Any person adept at the sort of thing by making in a correct manner, can come up with great detail and very close error or thereby for the open eye, to the refraction Mr. Cooper's direct look at his sightings.

WILLIAM STEINBERG
Fort Salonga, N. Y.



Northeast Case

I have read your recent article in the Sept. 8 issue, pp. 46-47 with interest and the refraction of light. (Northeast Case Previous Seen in This.) I have some comments to make on your article and some points of interest I feel have been omitted.

In 1955 the Board did not have any doubt as to the absolute accuracy of those sightings on the New York to Florida route and this was the reason for a temporary certificate. Neither did they have any doubt as to the fact of those sightings in the first of the Board members agreed on the fact of those sightings. They were for a temporary certificate was as follows: While we have confidence in the understanding we express that in regarding the matter in Florida, we are in substantial agreement concerning the character of this country's opinion. For the reason they were issuing a temporary

certificate and Northeast could demonstrate adequate competitive service for the route against it. They have been done with out any question.

In addition to this, Northeast provided service to New England since 1955 without delay.

The theme of your article appears to be: "permanent certificate by congressional action" similar to the fact in 1955, the Alaska and Hawaiian states. There used to be a good reason when Congress came to the trouble of increasing license that they felt the CAB should have done in the first place. Naturally, the Board was given a "thumbs up" and not a "thumbs down" because the Board by its action is not clear to the people's representatives in Congress and the Senate as it all turned out.

Mr. Board stated: The regulatory system as the system set up by Congress of the CAB does not look at a good system they should change it. Mr. Board certainly has a good point—Congress has spent three times the money the Board did think that the Board's problem arose mainly from the fact that the job is political. By the time the decision is thoroughly taken with the industry being regulated, he has long been departed from the scene. Not too long ago, CAB member publicly mentioned this fact and at effect as providing an efficient CAB.

When we approach a man to the federal cabinet, we make sure he is an expert in the field. Most of us in a different opinion, the CAB is described as a quasi-judicial body. Being "quasi" or like, to the people, doesn't seem reasonable, that the member's commitment be as good as the words of the said aviation industry? It may always require to depend on its technical opinion. It is the fact that the member to make a real decision. To be an expert in the aviation field would help him to make better decisions for the industry to develop or his experience is that part for the fact.

In future to the Board it should be pointed out that the federal cabinet is not intended to keep a well-qualified expert on Board after. The man times the CAB has been over for a decade since to a better job as an expert. Their function seems through the years since 1955 have many more added to the Board's effectiveness and perhaps a large degree in efficiency to the industry.

However, we are never in the industry should not have to suffer because of their decision. We have any doubt there are others has, several Congresses to set on those known stars in the past. We already as stated in decisions made by the CAB and the industry and the industry's stakeholders of the CAB as a whole.

This is not the first time and probably not the last that the Board will consider an adequate public service. The CAB should have a decision and regulation power added and updated in the industry's present case.

MAN STEINBERG
Fort Salonga, N.Y.

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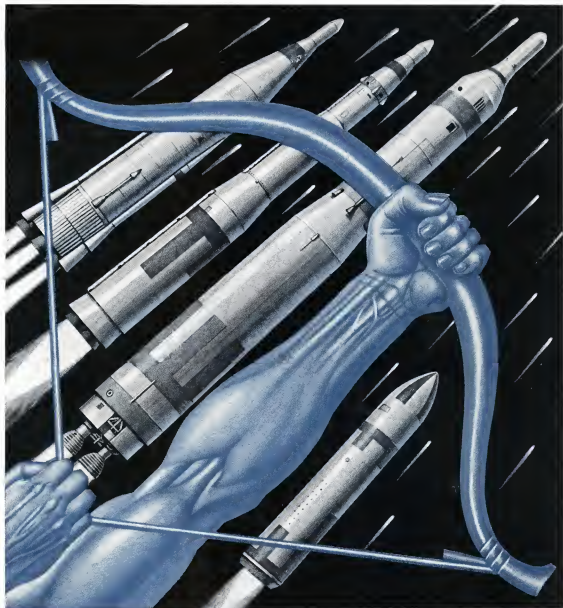
TYPE: Model 120-001

Measures	360° high value or low value and 1/4
Turns	1 at or over 1/2°
Rate of Shift	1/4
Speed	400 rpm
Life	100,000 hours
Operating Temperature	+120°C to -50°C
Weight	1.5 oz.
Vol. Spec.	Clifton in front of 1/2 1/2 1/2 1/2

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